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NEW RIVER AND PHOENIX CITY STREAMS ARIZONA OVERALL
MASTER PLAN(U) ARMY ENGINEER DISTRICT LOS ANGELES CALIF
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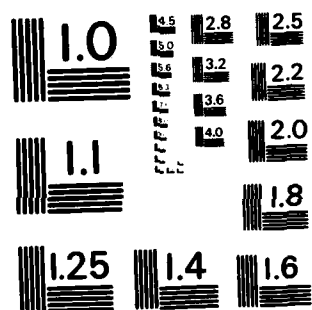
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New River and Phoenix City Streams, Arizona Overall Master Plan

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Design Memorandum No. 4

September 1980

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Los Angeles District**

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Phoenix Arizona, and Vicinity (Including New River) flood control project provides-flood protection to the Metropolitan Phoenix area. This document presents the master plan for development of the project lands associated with the four dams and one channel.		

OVERALL MASTER PLAN

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REPORTS PREVIOUSLY ISSUED

Title	Date	Date Approved by OCE
Interim Report on Survey for Flood Control--Phoenix, Arizona and Vicinity (including New River)	Jan. 1964	May 1965
Feature Design for Dreamy Draw Dam, Gila River Basin, New River and Phoenix City Streams, Arizona	Jan. 1972	May 1972
Final Environmental Impact Statement, Dreamy Draw Dam, Maricopa County, Arizona	Mar. 1972	May 1972 (filed with CEQ)
New River and Phoenix City Streams, Arizona, Hydrology, Part 1	Oct. 1974	Mar. 1975
New River and Phoenix City Streams, Arizona, Design Memorandum No. 3, General Design Memorandum--Phase I, Plan Formulation	Mar. 1976	July 1977 (SPD app)
Final Environmental Impact Statement, New River and Phoenix City Streams, Maricopa County, Arizona	Mar. 1976	Sept. 1976 (filed with CEQ)
New River and Phoenix City Streams, Arizona, Design Memorandum No. 3, General Design Memorandum--Phase II, Project Design		
Part 1--Cave Buttes Dam (including Cave Creek to Peoria Avenue)	July 1976	July 1977
Part 2--Adobe Dam (including Skunk Creek to the Arizona Canal)	Apr. 1979	

REPORTS CONCURRENTLY ISSUED

Title	Date Approved by SPD
New River and Phoenix City Streams, Arizona, Design Memorandum No. 4, Overall Master Plan	Sept. 1980
New River and Phoenix City Streams, Arizona, Design Memorandum No. 5, Master Plan and Feature Design Memorandum, Dreamy Draw Dam	Sept. 1980

REPORTS SCHEDULED FOR FUTURE ISSUANCE

Title	Scheduled Date
New River and Phoenix City Streams, Arizona, Design Memorandum No. 3, General Design Memorandum--Phase II, Project Design	
Part 3--New River Dam (including New River to Skunk Creek)	Apr. 1982
Part 4--Skunk Creek and New and Agua Fria Rivers below the Arizona Canal Diversion Channel	Apr. 1983
Part 5--Arizona Canal Diversion Channel (including Cave Creek Channel)	Dec. 1983
New River and Phoenix City Streams, Arizona, Design Memorandum No. 6, Master Plan and Initial Development Feature Design Memorandum, Cave Buttes Dam	Feb. 1981
New River and Phoenix City Streams, Arizona, Design Memorandum No. 7, Master Plan and Initial Development Feature Design Memorandum, Adobe Dam	Mar. 1981
New River and Phoenix City Streams, Arizona, Design Memorandum No. 8, Master Plan, New River Dam	July 1982
New River and Phoenix City Streams, Arizona, Design Memorandum No. 9, Future Development Feature Design Memorandum, Cave Buttes Dam	Sept. 1983
New River and Phoenix City Streams Arizona, Design Memorandum No. 10, Feature Design Memorandum, New River Dam	July 1985

REPORTS SCHEDULED FOR FUTURE ISSUANCE (Continued)

Title	Scheduled Date
New River and Phoenix City Streams, Arizona, Design Memorandum No. 11, Future Development Feature Design Memorandum, Adobe Dam	Sept. 1989
New River and Phoenix City Streams Arizona, Design Memorandum No. 12, Feature Design for Cultural Resources Interpretive Center	*

* Not determined

GLOSSARY

FDM	Feature Design Memorandum
EIS	Environmental Impact Statement
SCORP	Statewide Comprehensive Outdoor Recreation Plan
AORCC	Arizona Outdoor Recreation Coordinating Commission
VATTS	Valley Area Traffic and Transportation Study
MAGTPO	Maricopa Association of Governments Transportation Planning Office

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ERRATA SHEET

Changes to the report made in
July of 1981 in response to
South Pacific Division comments
are attached. Pages effected:

Cover Sheet

Pg. iii, v, vi, ix, x, xi, xii, 1, 2, 3, 4, 4A, 7, 8, 21, 22
23, 24, 35, 36, 59 - 70, 73, 74, 75, 81, 82, 82A, 83 - 85.

Phoenix, Arizona and Vicinity (including New River)

OVERALL MASTER PLAN

Design Memorandum No. 4

U.S. Army Corps of Engineers
Los Angeles District
September 1980

Revised July 1981

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New River and Phoenix City Streams, Arizona, Design Memorandum No. 8, Master Plan, New River Dam	July 1982
New River and Phoenix City Streams, Arizona, Design Memorandum No. 9, Future Development Feature Design Memorandum, Cave Buttes Dam	Sept. 1983

¹These portions of the Project Design report will show recreation features from basic planning concepts to Feature Design quality. No individual Master Plans or FDMS are anticipated for recreation development in these project reaches.

REPORTS SCHEDULED FOR FUTURE ISSUANCE (Continued)

Title	Schedule Date
New River and Phoenix City Streams Arizona, Design Memorandum No. 10, Feature Design Memorandum, New River Dam	*
New River and Phoenix City Streams Arizona, Design Memorandum No. 11, Future Development Feature Design Memorandum, Adobe Dam	Sept. 1989
New River and Phoenix City Streams Arizona, Design Memorandum No. 12 Feature Design for Cultural Resources Interpretive Center	*

* Not determined

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Chapter 1

INTRODUCTION

A. PROJECT AUTHORIZATION. The New River and Phoenix City Streams project, also known as the Phoenix, Arizona, and Vicinity (including New River) project, was authorized by the Flood Control Act of 1965 (Public Law 89-298), approved 27 October 1965. Section 4 of the Flood Control Act of 1944, as amended by Section 207 of the Flood Control Act of 1962, made it possible for the Corps to construct, maintain, and operate public parks and recreation facilities at water resource development projects. The law also permits the Corps to authorize local interests to construct, maintain, and operate recreation facilities.

B. PROJECT PURPOSE. The authorized purpose of the project is to provide flood protection to residential, commercial, industrial, agricultural, and public and semipublic lands within the Phoenix metropolitan area (pl. 1). As a result of comments by the Board of Engineers for Rivers and Harbors, recreation development was investigated and determined to be economically justified and therefore included as a project purpose. After that determination, the board, in cooperation with appropriate State and Federal agencies, recommended the proposed detention basins be modified to include fish and wildlife enhancement, as well as recreation facilities (pl. 2).

C. PURPOSES OF OVERALL MASTER PLAN. The primary purposes of this report are: (1) to provide a basis for understanding the factors influencing development and the intervening relationships among the resources and recreation features at the New River and Phoenix City Streams project, and (2) to tie together the proposed separate master plans for each of the project features into a comprehensive recreation system.

D. SCOPE OF OVERALL MASTER PLAN. The scope of this report provides a general overview of flood control features, recreation features, land use plans, time schedules, cost estimates, project management, and factors (environmental, social, and economic) affecting resource development within the Phoenix metropolitan area. Subsequent to this report, four master plans and one feature design memorandum (FDM) resource use appendix will be prepared for separate features of the project; these plans will include more detailed accounts of the resources and recreation development planning.

E. FUTURE MASTER PLANS. The recreation master plans will be presented as four separate documents; each will be devoted to the recreation features of one of the flood control projects. This method of presentation was selected because it is unlikely that each of the projects will have the same recreation sponsor. Differing sponsors will require distinct cost sharing agreements, as well as distinct planning

and design activities, for essential coordination on each project. These smaller documents can be more easily understood, distributed, and analyzed by the local sponsors.

One of the individual recreation master plans and a flood control FDM recreation appendix will combine development features at sites that are mutually dependent: (a) Cave Buttes Dam area and Cave Creek Regional Park, and (b) Arizona Canal diversion channel and Skunk Creek, and the New and Agua Fria Rivers. The combining of these complementary features will result in a savings of time and money, yet still present a cohesive and usable plan for local recreation sponsors.

In most cases, the master plans and initial development FDMs will be presented as one document. The master plan will embody the conceptual land uses based on environmental, social, and economic investigations presented in the environmental impact statement (EIS) and delineated in the text for the study area. Factors influencing development are described within the text and are the basis for the recommended recreation site development plan. The master plan precedes the FDM and furnishes the basic concepts, plans, and support needed to complete the FDM.

The portion of the report devoted to the initial development FDM will provide the necessary detailed information required for preparation of plans and specifications. In the case of a phased recreation development plan, such as Cave Buttes, a separate FDM for future development may be produced. In initial development, shortly after completion of the flood control project, fewer recreation features will be available. As residential development occurs, future development of more urban-oriented recreation opportunities will be implemented.

Some elements of the master plan will be periodically updated, as required by perceived or real needs of the local recreation sponsor and the community. The FDM then will be revised to reflect these modifications.

The Dreamy Draw, Cave Buttes, and Adobe Dam projects will have the master plan and initial development FDM combined. The New River Dam project will be produced as a master plan only¹. Recreation features for the Arizona Canal diversion channel and Skunk Creek, and New and Agua Fria Rivers will be included as appendices to Part 4 and 5 of the Phase II GDM.

F. FUTURE PERTINENT REPORTS. Following is a list of resource use related design memoranda scheduled for future issuance and a brief statement describing the content of each.

¹An FDM will be provided only if recreation is recommended in the Master Plan and a local sponsor is available.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 5,
Master Plan and Feature Design for Recreation,
Dreamy Draw Dam.

Sept. 1981

The master plan will analyze the resources of the area, describe a specific plan for recreation development, and provide the basis for the preparation of plans and specifications.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 6,
Master Plan and Initial Development Feature
Design Memorandum, Cave Buttes Dam

Oct. 1981

The master plan will describe the resources of the area and their effect on developing a land use plan for the basin, discuss the recommended land uses and their general location, and include the development plan for Cave Creek Regional Park, previously prepared by the City of Phoenix and the Corps of Engineers. This report will also detail the specific types, numbers, and locations of recreation facilities to be developed under the Initial Development Feature Design Memorandum.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 7,
Master Plan and Initial Development Feature Design
Memorandum, Adobe Dam

Mar. 1982

The master plan will describe the resources of the area and their effect on developing a land use plan for the basin, show the relationship of the contiguous Thunderbird Park, and outline a comprehensive land use plan within the project boundaries. This report will also detail the specific types, numbers, and locations of recreation facilities to be developed under the Initial Development Feature Design Memorandum.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 8
Master Plan, New River Dam

July 1982

The master plan will describe the resources of the area and their effect on developing a land use plan for the basin and outline a comprehensive land use plan within the project boundaries.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 9, Future Development
Feature Design Memorandum, Cave Buttes Dam

Sept. 1983

The feature design will detail the specific types, numbers, and locations of recreation facilities to be developed under the Future Development Feature Design Memorandum. This document will provide the basis for preparation of project plans and specifications.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 10, Feature Design
Memorandum, New River Dam

Not Determined

The feature design will detail the specific types, numbers, and locations of recreation facilities to be developed within the basin. This document will provide the basis for preparation of project plans and specifications.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 11, Future Development
Feature Design Memorandum, Adobe Dam

Sept. 1989

The feature design will detail the specific types, numbers, and locations of recreation facilities to be developed under the Future Development Feature Design Memorandum. This document will provide the basis for preparation of project plans and specifications

G. PRIOR PERTINENT REPORTS. A list of previously issued design memoranda appears in the front matter of this report. Some of those reports, plus others applicable to the overall development of the New River and Phoenix City Streams features, are listed below:

New River and Phoenix City Streams, Arizona
Design Memorandum No. 1,
Feature Design for Dreamy Draw Dam

Jan. 1972

Final Environmental Impact Statement,
Dreamy Draw Dam, Maricopa County, Arizona

Mar. 1972

Final Environmental Impact Statement,
New River and Phoenix City Streams
Maricopa County, Arizona

Mar. 1976

G. PRIOR PERTINENT REPORTS. A list of previously issued design memoranda appears in the front matter of this report. Some of those reports, plus others applicable to the overall development of the New River and Phoenix City Streams features, are listed below:

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Final Environmental Impact Statement, Dreamy Draw Dam, Maricopa County, Arizona	Mar. 1972
Final Environmental Impact Statement, New River and Phoenix City Streams Maricopa County, Arizona	Mar. 1976

H. REFERENCES. The following references were used in the New River and Phoenix City Streams project.

Arizona Climate, Ed. William D. Sellers and Richard H. Hill, Tucson, Arizona, U. of Arizona Press, 1974.

Arizona Republic and Phoenix Gazette, Inside Phoenix 1978, Phoenix, Arizona, Phoenix Newspapers, Inc. 1978.

Arizona State University, An Archeological Survey of the Cave Buttes Dam Alternative Site and Reservoir, Arizona, Anthropological Research Paper No. 8, by James B. Rogers, with Appendix by Donald E. Weaver, Jr., Department of Anthropology, Tempe, Arizona, 1974.

Demaree, Salome R., Eleanor L. Radke, and Janet L. Witzeman: Annotated Field List, Birds of Maricopa County, Arizona, Phoenix, Arizona, Maricopa Audubon Society, 1972.

Elements of Outdoor Recreation Planning, Ed., B.L. Driver, and Ann Arbor, U. of Michigan, Press, 1970.

Maslow, Abraham H.: Motivation and Personality, New York, Harper and Row, 1954.

Thiele, Heinrich J.: Present and Future Water Use and Its Effect on Planning in Maricopa County, Arizona, (Phoenix, Arizona) Maricopa County Board of Supervisors and the Maricopa County Planning and Zoning Dept., September 1965.

U.S. Department of Agriculture, Soil Conservation Service, General Soil Map, Maricopa County, Arizona, Washington, D.C., U.S. Government Printing Office, 1969.

U.S. Government Printing Office, House Document No. 94-51, 94th Congress, 1st Session, Serial No. 94-A, Report on Endangered and Threatened Plant Species of the United States, Washington, D.C. 1975.

Valley National Bank of Arizona, Arizona Statistical Review, Phoenix, Arizona, Economic Research Dept., Valley National Bank, 34th Edition, 1978.

I. APPLICABILITY OF SELECTED PUBLIC LAWS. The following laws provide guidance for the development and management of Federal projects for various purposes according to the intent of Congress and as they apply to the New River and Phoenix City Streams Project:

a. Section 4, Public Law 78-534 (The Flood Control Act of 1944), as amended, authorizes the Corps of Engineers to construct, maintain, and operate public park and recreation facilities at water resource development projects and to permit local interests to construct, maintain, and operate such facilities.

b. Public Law 85-624 (The Fish and Wildlife Coordination Act of 1968) provides for the integration of fish and wildlife conservation in water resources projects. The U.S. Fish and Wildlife Service has prepared a report, dated 1 February 1978, pertaining to the fish and wildlife resources of the project area. This report was published as Exhibit D in Adobe Dam Design Memorandum No. 3 GDM-Phase II Project Design Part 2 April 1979. The recommendations and findings contained in the report pertained to borrow site locations and compensation for wildlife habitat destruction and have been given full consideration. The borrow sites for the projects were located in areas of less dense vegetation to reduce habitat loss. Acreage has been acquired to compensate for wildlife habitat destroyed by the project and is now being managed by the Arizona Game and Fish Department for fish and wildlife conservation purposes. Coordination with related State and Federal agencies was maintained during the development of this master plan.

c. Public Law 89-72 (The Federal Water Project Recreation Act of 1965), accompanied by House Committee Report 254, states that full consideration shall be given to the opportunity, if any, the project affords for outdoor recreation and fish and wildlife enhancement. It also provides for non-Federal participation in land acquisition and in the development and management of recreation facilities and fish and wildlife resources.

d. Section 204, Public Law 89-298 (The Flood Control Act of 1965) authorizes the Corps of Engineers to construct the New River and Phoenix City Streams Flood Control Project for flood protection in Phoenix, Arizona, and vicinity.

e. Public Law 91-190 (The National Environmental Policy Act of 1969) requires that the environmental effects of each project and the means and measures to minimize any adverse effects be evaluated and presented in an EIS. The EIS for the New River and Phoenix City Streams project addresses the impact of recreation development associated with the project. These impacts have been considered in the development of land use plans for the project areas.

Chapter 4

ENVIRONMENTAL RESOURCES

A. GENERAL. The following section presents the environmental resources considered as a whole in the development of the land use plan for the New River and Phoenix City Streams project. The intrinsic qualities of the environmental resources for the projects will be identified in this section leading to the development of appropriate resource uses.

B. CLIMATOLOGY. The project area is located in the Sonoran Desert Climatic Zone. The climate of the project area, like that of the City of Phoenix, is dry, receiving an average of less than 8 in. (203.2 mm) of precipitation a year. Summer thunderstorms of high intensity, but short duration, bring 40% of the annual rainfall. The summers are hot and the winters are mild, with clear days and cool nights. U.S. Weather Bureau records indicate a long-term average temperature of about 70° F (21.1° C), with the temperature ranging from a summer maximum commonly above 100° F (38° C) to a winter minimum seldom below 32° F (00° C). The prevailing winds are from the east during the day and from the west at night. Average wind velocities are low to moderate, approximately 6 mph (10 km/h) except for high gusty winds that may accompany July and August thunderstorms. A graphic summary of the climate is provided on plate 3.

The project area has an average relative humidity ranging from 24 percent in the summer to 54 percent in the winter. Relative humidity has increased in the Phoenix area as the result of large irrigated areas, open canal systems, and urban plantings. The combination of high temperatures, low relative humidities, a maximum amount of sunshine, and wind causes a high evaporation rate estimated at 6.5 ft (2 m) per year.

C. PHYSIOGRAPHY. All of the flood control features are located in the Sonoran Desert region of the basin and range physiographic province. The project area is within the Gila River Basin; this is the largest drainage area tributary to the lower Colorado River, comprising 58,200 mi² (150,738 km²). About 70 percent of the drainage area is mountainous, while the remainder is alluvial valley. The Phoenix metropolitan area, situated in the Salt River Valley, is effectively surrounded by the Phoenix Mountains to the north, the McDowell Mountains to the northeast, the Usury Mountains to the east, the South Mountains to the south, and the Sierra Estrella to the southwest. Only to the west and southeast do the rolling desert plains typical of the metropolitan area continue uninterrupted. The mountains are characterized by rugged terrain and steep gradients, while the valleys are fairly flat with regular slopes. Elevations range from 910 ft (277 m) at the confluence of the Agua Fria and Gila Rivers to 7000 ft (2134 m) in the mountains near the headwaters of the Agua Fria River.

D. **GEOLOGY.** The project area is located in the Sonoran Desert Section of the basin and range physiographic province. This province is characterized by steep mountains and broad alluvium-filled valleys. The mountain ranges, which are generally parallel and trend northwest to southeast, are composed of metamorphic and volcanic rock. The basins are filled with alluvial and colluvial materials--primarily gravel, sands and clays--to depths of over 1000 ft (305 m). The valley floor was formed by extensive alluvium deposits, which have filled the basin and covered the foreslopes of the hills and mountains. Alluvium in the valley may extend to depths of over 1000 ft (305 m) and consists of coarse, unconsolidated, unsorted sands, gravels and cobbles. The deep dissection of the mountains and the extent of the alluvial fans suggest that the project area has had a long history of erosion and deposition.

E. **SEISMICITY.** The earthquake potential in the project area is considered small. On the Seismic Risk Map of the United States, the area is arranged to zone 2, which is a low seismic risk zone. Severe earthquakes in California and Mexico have been widely felt throughout southern Arizona, but only a few weak earthquakes have had epicenters in southern Arizona during the recorded earthquake history.

F. **HYDROLOGY.** The watercourses of the Agua Fria River, New River, Gila River, and Skunk Creek are generally characterized by well defined floodways and channels. The channels of Cave Creek and Dreamy Draw are well defined above the Arizona Canal; downstream from the Canal, the natural floodways have been obliterated by urban development. Flows in the channels are ephemeral because climate and drainage characteristics are not conducive to continuous runoff. Flows occur only during and immediately after periods of heavy rainfall.

Surface flows percolate through the ground and may enter the ground water supply. Current urbanization is causing an appreciable increase in the amount of impervious area, especially in the lower reaches of the drainage area. Thus a lesser amount of flow is percolated, and the amount of runoff flow is increased. In addition, increased urbanization, through the increases in the impervious area and paving of streets, has resulted in increased velocities of flows with a resultant increase in peak discharges. The increase in runoff flow and peak discharge are causes of increased flooding.

G. **GROUND WATER.** The ground water basin is generally bounded on the north and east by the McDowell Mountains; on the south by the South Mountains; on the southwest by the Sierra Estrella Mountains and Buckeye Hills; on the west, by the White Tank Mountains. Aquifer depth to bedrock exceeds 1000 ft (305 m) over much of the ground water basin (Thiele, 1965). Ground water occurs in discontinuous layers and lenses in the sands and gravels of the basin alluvium. Within the project area, the depth to ground water can vary tremendously--from only a few feet along the Salt River to several hundred feet along Cave Creek.

H. SOILS. The soil types in the study area are derived from parent materials characteristic of the basin and range physiographic province. The soils in the gently sloping valleys are deep, heterogeneous in texture, low in organic material, and have not been leached of soil nutrients. The relatively level surface, combined with soils of favorable workability, provide areas of good cropland where irrigation is available. General soil types in the project area are sandy loams, limy clay loams, and limy loamy soils (U.S. Department of Agriculture, 1969). Stony and rocky soils are locally present on slopes greater than 30 percent. The soils in the study area are commonly affected by the precipitation of salts produced by weathering of rock-forming minerals and brought in by surface runoff. Because seepage from rainfall is usually not sufficient to carry salts down to the water table, they accumulate in the soil as the water evaporates. The effects are most noticeable near mountains formed of calcium-bearing rocks, where alluvial deposits are commonly cemented by calcium carbonate to a concrete-like material called caliche. Farther down the basin slopes, calcium carbonate content decreases, but soluble alkali salts detrimental to agriculture are still present. Erosion from the drainage above the proposed dams was calculated by the Corps of Engineers for the purpose of determining sediment storage requirements in the reservoirs. The sediment yield of 0.3 acre-ft/mi² (.0143 ha-m/km²) was estimated for the drainage area upstream of the dams.

Site specific soils may vary with each flood control feature. These will be identified in the individual feature master plans.

I. VEGETATION. The project area and adjacent lands are typically Arizona desert, which is part of the Sonoran Desert Region. Geographically, the project areas are typified by broad desert valleys and desert mountains. The vegetation types include perennial and ephemeral desert shrub, with scattered riparian communities along the drainageways. The riparian plants are mesquite, ironwood, desert willow, and paloverde. The perennial vegetation is characterized by ocotillo, catclaw, desert broom, creosotebush, barsage, and such cacti as saguaro, cholla, and prickly pear. The ephemeral class is distinguished by annual forbs and grasses.

Environmental disturbances have occurred in the various desert wash habitats and, to a lesser degree, in the desert outwashes and upland habitats. Gravel mining, roads, farming, grazing, and trails account for most of the loss or heavy disturbance of desert wash and outwash vegetation. Construction of the project features also will lower the quantity and quality of habitat areas. However, acquisition of offsite lands and revegetation of borrow areas and embankments will help to mitigate the impact of habitat losses.

J. RARE AND ENDANGERED VEGETATION. The State of Arizona has statutes protecting various native plants growing wild on State, or publicly and privately owned lands. The statutes are administered by the Arizona Commission of Agriculture and Horticulture. Among the protected plants are all species of the lily, amaryllis, orchid, orpine, and cactus family. It is unlawful to take or transport protected plants from their original growing site without a valid permit from the Commission of Agriculture and Horticulture. The Endangered Species Act of 1973 provided for the establishment of a Federal endangered plants lists. A report on Endangered and Threatened Plant Species of the United States was published by the U.S. Government Printing Office, 1975.

K. WILDLIFE. Wildlife is present in all the various habitats (natural desert communities, agricultural, and urban) within the study area. The largest number and greatest diversity of desert fauna within the Phoenix project area appear to occupy the desert wash and upland habitats north of Phoenix. This is related to the abundance of wildlife plant foods in these habitats. Areas of intensive urban development and agricultural activity usually have a limited wildlife diversity and abundance, although some bird species flourish around agricultural areas. Wildlife found in various habitats throughout the Phoenix study area includes: amphibians and reptiles, such as toads, frogs, lizards, and snakes; many bird species, as indicated by a listing of 346 species in the annotated field lists of Birds of Maricopa County (Demaree, Radke, and Witzeman, 1972); and mammals, such as bats, rodents, skunks, rabbits, coyotes, and deer.

Although desert wildlife species are adapted to very dry conditions, most species depend on some free water. Consequently, animals are most abundant where water or succulent foods are available. The streambeds and riverbeds attract and concentrate animal populations at various times, depending on the availability of food, water, and cover. Periods of rainfall usually occur in the Phoenix area during both summer and winter, providing at least temporary sources of water. Some gravel pits along the drainages in the study area contain ponded water throughout most of the year. Effluent from sewage treatment plants and sedimentation ponds, such as along New and Agua Fria Rivers, also provides water sources for wildlife in the Phoenix area.

Wildlife, particularly birds, is concentrated by the vegetation in desert washes and along major creeks and rivers. This vegetation, especially mesquite, provides important nesting, feeding, resting, and roosting sites. As agricultural, mining and urban uses have eliminated much of the natural habitat along the major drainageways in the area, the remaining riparian habitat is particularly important to wildlife as a refuge area providing adequate food and cover sources.

Although some reaches of the Agua Fria and New Rivers and Cave and Skunk Creeks remain relatively natural, the biological communities along most of the channels have been considerably altered as a result of sand

Because Maricopa County has a low-density population and widely dispersed urban growth, an adequate public transportation system has not developed. In 1977, the county had 383 buses and 251 taxis. As additional buses have been added, passenger use has increased, but still only 0.5 percent of the total trips are made on busses.

Existing and proposed large-scale developments are not likely to become autonomous satellite cities. It is unlikely that mass transit links to the high employment areas of Phoenix will be provided, and even if mass transit were provided, it is unlikely that it would replace the automobile. Consequently, the amount of traffic moving into Phoenix will increase. In the Phoenix area, transportation planning has been conducted over the past several decades. A major street and highway plan was adopted for the area in 1961, and the Valley Area Traffic and Transportation Study (VATTS) was established as an ongoing transportation planning program for the metropolitan Phoenix area in 1965. In 1977, the Maricopa Association of Governments Transportation Planning Office (MAGTPO) completed the Phoenix Urban Area Transportation Plan, as directed by the U.S. Department of Transportation.

6. Housing. As of October 1, 1977, the Republic-Gazette survey reports the following breakdown of housing in the Phoenix metropolitan area: single family dwellings, 63 percent; multiple-family dwellings, 20 percent; townhouse units, 6 percent; mobile homes, 10 percent. The median housing value of owner-occupied single family dwellings rose from \$18,500 in 1970 to \$35,615 in 1978.

In 1977, 17 percent of the housing units in Maricopa County were substandard; these are year-round housing units economically unfeasible to rehabilitate. The ethnic communities near the Salt River in the Phoenix metropolitan area contain a large amount of this substandard housing.

Assuming conditions continue to be favorable for the construction of multiple-family dwellings, it is expected their percent of the total housing will continue to increase. Large parcels of land on the periphery of the urbanized area will continue to attract housing development. Twenty-eight planned developments (ranging from a few hundred to 5,000 persons) are now approved and under construction. Six other planned developments are approved, with a design population as high as 26,000 persons. Nine possible future large-scale developments in Maricopa County are awaiting approval. These developments total 127,421 acres (51 566 ha), with a total design population of 765,190 persons.

E. ACCESSIBILITY. The project sites are easily accessible from the Phoenix metropolitan area by paved surface roads. All sites, except New River Dam, are within close proximity to the City of Phoenix.

F. SOCIOLOGICAL PERSPECTIVE. The planning process of the recreation facilities should identify the leisure needs and preferences of the potential users. These users, who are basically urban consumers, live within the Phoenix metropolitan area and make specific demands on open space development. Planning of recreation resources should recognize the needs and desires of the users they are planned to serve.

1. Recreation Land and the Urban Consumer. Recreation land should be a functional part of the overall environment, including the daily life styles of the community. Besides providing recreation opportunities, this land also preserves valuable scenic and natural resources.

The environmental resources of the project areas offer exceptional opportunities for year-round outdoor recreation and high participation rates. The unique nature of the desert, typified in the project areas, offers the urban recreationist a chance to experience the natural environment close to home.

2. The Urban Consumer. The city serves as a center of business, cultural, and social activities. These meet many of the basic needs of survival, safety, and security, and also the higher-level needs of comfort, joy, and pleasure, as identified by Maslow. Open space also can be used to achieve these higher level needs. Recreation resources are used by the urban consumer for conducting activities he either finds there or brings with him to satisfy these inner needs.

The 1978 National Urban Recreation Study identifies urban recreation needs that include the following:

- o The conservation of open space for its natural, cultural, and recreation values
- o The provision of close-to-home recreation opportunities
- o The encouragement of joint use of resources
- o The provision of environmental education and management as an integral part of recreation areas

Due to the highly developed consumer values of convenience, coupled with more leisure time and increased discretionary income, pressure is applied on the limited amount of easily accessible recreation resources available in an area. The urban consumer wants to be with people, and only occasionally seeks out-of-the-way, uninhabited places.

The proposed recreation areas are incrementally necessary and complete, while also functioning as a complementary system supplementing identified recreation needs of the area. The general plans for development are described in the following paragraphs.

B. DREAMY DRAW DAM. The Dreamy Draw basin is surrounded on all sides by the 7700-acre (3116-ha) Phoenix Mountains Preserve. The Master Plan for the Phoenix Mountains Preserve, prepared by the City of Phoenix, calls for development of outdoor recreation and education facilities that are compatible with open space values. Less than 7 percent of the preserve area will be developed. Development at the preserve will include a scenic drive with overlooks, a nature study center, picnicking areas, neighborhood parks, and an equestrian center that will be located near Dreamy Draw Dam. Since hiking and riding trails in the preserve will extend northwest, south, and east of Dreamy Draw, the site is a desirable location for a trail ride assembly area.

The City of Phoenix has already developed an access route to the downstream area of Dreamy Draw Dam from the recently completed Paradise Valley Access Relief Road. Tunnels constructed under 19th Street, Dreamy Draw Drive, and the Paradise Valley Access Relief Road provide access to Dreamy Draw from the Phoenix Mountains Preserve. One of these tunnels can accommodate automobiles. Informal and overflow parking for the assembly area will be provided in the basin area.

A group ramada site with 20 tables and barbeques will serve as a meeting place where riding groups can assemble, enjoy meals, and plan rides. A paved multiuse area, fire rings, horse tie-ups, and a horse watering trough also will be located near the group picnic site. Located above the 100-year flood elevation, the ramada site affords a good view of the basin. Areas of irregular topography and natural growth make picturesque and relatively secluded locations for three individual ramadas nearby. These sites will be used by small groups and by hikers, joggers and equestrians passing through the Dreamy Draw area. A tunnel will be constructed so that riders can cross under Northern Avenue and enter the Dreamy Draw Dam basin from the northern portion of the Phoenix Mountains Preserve. Rest room facilities will be provided for the convenience of recreationists using the Dreamy Draw Dam area. All of the items planned for the Dreamy Draw basin will be cost shared with the City of Phoenix.

The current plan for development of the Dreamy Draw Dam area will be further discussed in the Master Plan and Feature Design Memorandum, Design Memorandum No. 5 (pl. 9).

C. CAVE BUTTES DAM. Cave Buttes Dam is about 0.7 miles (1.1 km) below the existing Cave Creek Dam and about 10 miles (16 km) north of central Phoenix in the southern portion of the Union Hills. A two-phased recreation development is planned for Cave Buttes.

The Cave Buttes detention basin is well-suited for activities that require large areas of relatively flat land. The initial phase of development will include nonurban type recreation facilities (pl. 10a). These facilities will require a low capital investment and low maintenance. All of the initial recreation development will be cost shared with the local sponsor.

The Cave Buttes area is currently used for informal equestrian activities. Cave Creek, known as horse alley, is used as a route to riding trails north of the damsite area. The recreation plan will officially designate approximately 300 acres (121 ha) in the northern part of the detention basin as an open riding and combined training area. Riding clubs could use this area as a meeting place and point of departure for organized trail rides. Trail systems through areas of dense desert-wash vegetation and sandy streambeds will be provided for equestrians and nature observers to penetrate esthetically pleasing and diverse environments. The trails in the basin will connect with existing and proposed trails located north and south of the site. A paved automobile road with a bikeway will afford easy access to the proposed recreation facilities.

Field-dog training organizations in the Phoenix area have expressed the need for open space designated for field-dog training. The area immediately upstream from the proposed Cave Buttes Dam is a suitable location for retriever dog training, while the area upstream of Cave Creek Dam on the west side of the basin will be used for pointer dog training activities.

A group camping area will be located above the 50-year flood elevation adjacent to scenic drainage areas. Individual walk-in camping will be provided in the less accessible northeastern-portion of the basin.

A multi-purpose field will be provided within the northern area of the basin. This unturfed area may be used by groups for such activities as dog shows, equestrian events, rock shows, and hot air balloon launching. The site will be turfed in Phase II.

Model airplane flying is an existing activity at the borrow area immediately north of dike no. 2. This use will continue in Phase I with the space improved by the addition of a paved runway and parking area.

Cave Buttes Dam will be Arizona's main center for equestrian combined training (three-day events). Space will be available for visitors to erect temporary corrals and arenas, and for horse trailer parking. These events will be held four or five times a year. At other times, supervised practice jumping will occur.

Picnic facilities are planned in a centrally located area of dense, bosque vegetation. Large mesquite and ironwood trees will provide a cool and scenic environment for picnic sites. Ramadas will be designed to have minimal visual impact on the natural landscape, and existing vegetative materials will be utilized for spatial definition, shade, and esthetic enhancement.

Restroom facilities will be positioned for user convenience throughout the recreation area. Access to facility areas will be provided by paved and unpaved roads, and, in locations convenient to the major recreation areas, parking areas will be provided.

An overlook structure and sun dial have been completed at flood control costs, as part of the Cave Buttes Dam construction contract. These features are located on a hill east of Cave Creek Dam. They provide a view of the historic Cave Creek Dam and panorama of the entire basin. The overlook also will serve as an observation point for viewing equestrian, balloon launching, and dog-training activities.

The second phase of recreation development will occur as demand warrants and urbanization encroaches on the lands surrounding the basin (pl. 10b). At this time, more urban facilities will be provided in conjunction with existing facilities. The majority of the future development will be cost shared with the local sponsor. Exceptions are mentioned in the text. Field and target archery is planned for the far west side of the basin. Additional centrally located picnic sites will be furnished to meet increasing demand.

A park center will house visitor information and a snack bar; it will be located adjacent to the recreation half of a proposed wildlife/fishing and boating lake. Each of the facilities will be provided without Federal participation. Boat launch facilities and a bait shop also will be in this vicinity and will be built without Federal participation. The western half of the lake will be devoted to wildlife enhancement. Extensive plantings of desert wash type vegetation on the western side of the lake will provide food and cover for wildlife. The wildlife half of the lake and its shoreline will be cost-shared as wildlife enhancement (75 percent Federal, 25 percent local). A nature trail and picnic area adjacent to the wildlife area will be cost shared as recreation. The impacts of the lakes will be assessed in the Environmental Assessment being prepared for recreation at Cave Buttes Dam.

Intensive recreation use will occur in and around the park center and lake. Active sports facilities, such as paved multiuse areas and athletic fields, will sustain the growing urban demands for these

facilities. Recreation vehicle parking and campsites will be developed immediately north of dike no. 2 and south of the access road. The existing model airplane flight area may be modified in this phase if needed. This area was highly disturbed during construction of the dike and was revegetated with native plants as part of the flood control contract. Placed north of Jomax Road above the recreation vehicle area will be locally developed golf course with a clubhouse. Additional parking and rest room facilities will be provided throughout the basin.

The Master Plan and Initial Development FDM for Cave Buttes Dam, Design Memorandum No. 6 will detail development plans.

- R D. CAVE CREEK REGIONAL PARK.* Inasmuch as discharges from Cave Buttes Dam flow down Cave Creek, and flood plain management is a project requirement along Cave Creek to the Arizona Canal, participation in the development of project-oriented recreation features along Cave Creek was considered desirable. However, during review of the Phase I Design Memorandum, it was determined that no policy currently exists to permit Federal cost sharing of recreation development in nonstructural flood control areas. The development plan for the nonstructural portion of Cave Creek (Cave Buttes Dam to Peoria Avenue), as well as that of the structural portion (Peoria Avenue to the Arizona Canal diversion channel), will continue to be included as part of the Cave Buttes Dam Master Plan and Initial Development FDM, Design Memorandum No. 6.

The channelized reach of Cave Creek from Peoria Avenue to the Arizona Canal diversion channel is eligible for recreation cost sharing. The greenbelt area upstream of this reach is included in the planning process because it provides a cohesive and necessary link between the recreation development planned for Cave Buttes Dam and the Arizona Canal diversion channel. In the event cost sharing policies are modified to permit Federal recreation cost sharing in nonstructural flood control areas, the Corps of Engineers may be able to participate in the development of the entire wash (pls. 11a-d).

As previously mentioned, recreation development along the structural portion of Cave Creek from Peoria Avenue to the Arizona Canal diversion channel is eligible for cost sharing with the Federal Government (pl. 11d). Proposed recreation development within this reach that can be cost shared include a 15 acre recreation area adjacent to the Arizona Canal Diversion Channel, picnicking facilities, portions of a scenic drive, riding and hiking trails that enter the site, and outdoor exhibits for a nature study center.

The remainder of the nature study center--consisting of indoor exhibits, meeting areas, research and study facilities--is planned without Corps participation. A maintenance yard is also planned within the site at local cost. An existing greenhouse complex south of Peoria Avenue has been acquired without Federal participation.

- R *The floodway developed downstream of Cave Buttes Dam was based on existing conditions in the flood plain at the time of completion of the dam. Hydraulic analysis did not consider this recreation concept.

The recommendation of flood plain management along Cave Creek will have the advantage of enabling local interests to realize their plans for a linear park along the wash. The 1990 land use plan for the City of Phoenix designates Cave Creek Wash from Cave Buttes Dam to the Arizona Canal as a regional park.

The City of Phoenix has already acquired approximately 450 acres (182 ha) along the wash between Greenway Road and the Arizona Canal for the purpose of recreation development. Stimulated by proposed recreation development along the Granite Reef aqueduct east of Cave Creek Road, the city plans to acquire additional acres along the wash north of Greenway Road so that Cave Creek Regional Park could extend north to Cave Buttes Dam, thereby connecting to the recreation facilities along the aqueduct and behind Cave Buttes Dam.

Cave Creek Regional Park will provide recreation facilities for users from adjacent neighborhoods, as well as recreationists from the entire Phoenix area. Because the park will adjoin several residential subdivisions that have no space reserved for recreation, small parks have been planned in selected locations. Other facilities, such as an outdoor education center and a scenic parkway, will attract users from more distant parts of the city. Facilities at the park will include picnic sites, playgrounds, paved multiuse areas, athletic fields, a nature study center, golf course, swimming pool, archery, wildlife preserve, orchard, petroglyph viewing, amphitheater, equestrian center, and model boating. Trails for hikers, joggers, bicyclists, and equestrians will thread the entire length of Cave Creek Regional Park. These trails will connect to those planned for the Arizona Canal diversion channel, Union Hills Park, the Granite Reef aqueduct, and Cave Buttes Dam. Rest room facilities will be conveniently located throughout the park.

F. ADOBE DAM. Adobe Dam will be constructed on Skunk Creek in the Little Deer Valley between the southern Hedgepeth Hills and Adobe Mountain. The site of the proposed Adobe Dam recreation area is surrounded on three sides by one existing and two proposed regional parks. Thunderbird Park is contiguous to the site, and the proposed Deem Hills Park and Skunk Creek recreation area will be located just north and east of the project site, respectively.

To assure continuity in planning and design, the Adobe area and Thunderbird Park have been planned as a single unit. Thunderbird Park is being developed by Maricopa County without Corps participation, and recreation facilities in the Adobe reservoir area will be cost shared. The two areas contrast in physiographic character. Thunderbird Park is rugged and mountainous; it is vegetated with grasses, perennial shrubs, and cacti. The Adobe site is flat and sparsely vegetated. This topographic variety presents the opportunity to develop facilities for diverse types of recreation activities.

The gentle and steep slopes and graceful, narrow valleys in Thunderbird Park are particularly well suited to the development of hiking and riding trails. A network of trails will traverse the mountain slopes and lead to peaks where scenic overlooks will be located. Picnic areas are in one of the valleys where an amphitheater has been constructed. Another valley in Thunderbird Park will be the site of a par three, nine-hole golf course. Other features planned by the county for Thunderbird Park are a recreation complex and a park headquarters.

The recreation complex in Thunderbird Park will be located adjacent to the south park entrance on 59th Avenue. This area will consist of high-density recreation facilities, because of its close proximity to the urban area and the fact that there is no other facility of this nature or size to satisfy the immediate recreation needs. Other major features of the park will be concentrated in this particular location because it is easily accessible to the surrounding urban communities. Space will be available for arts and crafts classes, along with public functions and activities at the civic center. The county's plan for Thunderbird Park also includes a recreation clubhouse that will serve as the hub for court games and regulation tennis matches. Other facilities in Thunderbird Park will include handball courts, shuffleboard, horseshoes, practice tennis courts, and tournament tennis courts with bleachers.

The Adobe Dam site consists of relatively level land and is bordered on the west by the Hedgepeth Hills. The site is suitable for a variety of recreation uses. The recreation concept is to phase the development to meet the recreation needs of an increasing population in the immediate area of the Adobe Dam site (pl. 12). Facilities developed first will include family picnicking facilities, hiking and jogging trails, multipurpose exhibition fields for dog shows, polo competitions and other spectator type activities, a children's play area, and dog training within the project borrow area and Skunk Creek. A paved, lighted access road running from Pinnacle Peak Road and 43rd Avenue one mile into the basin and one and a half miles of interior spur road will also be provided with the initial development. These facilities will be cost shared with the Federal Government. As the Phoenix urban area grows to encroach on the site, more intensive use facilities, such as paved multiuse areas and athletic fields, will be added.

A multi-use complex funded by Maricopa County is proposed for the Adobe Dam basin. It will be located in the northeast portion, south of Pinnacle Peak Road. Proposed facilities at the complex include an equestrian center with an enclosed arena, smaller open air arenas, corrals, training rings, and facilities for spectators. Also proposed is a privately funded aquatic facility located at the southeast corner of Pinnacle Peak and 43rd Avenue.

The Land Use Plan for 1990, prepared by the City of Phoenix Planning Department, shows that residential development in the vicinity of Adobe Dam will reach densities of up to five housing units per acre. According

to local standards, community-park type facilities, such as athletic fields and paved multiuse areas, should be provided within a 5-minute travel time of each housing unit and should service a population of approximately 20,000 persons. By 1990, the population within 5 minutes of Adobe Dam will well exceed 20,000 persons. The Park and Recreation Plan for Phoenix, Arizona (1978) states that man-made barriers to movement (such as freeways, and, in this case, the dam) generally do not impede trips to the site; a more important consideration is the time required for the trip to the site. Black Canyon Highway, 35th Avenue, and Pinnacle Peak Road provide access to the site.

Facilities that will be developed at Adobe Dam by 1990 are to be cost shared with the Federal Government and are discussed in the following paragraphs.

Camping facilities will be located in a secluded area that is surrounded on three sides by steep mountain slopes. There will be two group campsites, each to accommodate 100 campers as well as individual campsites. Campers could enjoy using hiking and riding trails that would connect with the network of trails planned for Thunderbird Park.

A picturesque area at the base of the Hedgepeth Hills has been chosen for the location of picnic facilities. The area has an eastern exposure, contains a variety of vegetative materials, and is the site of a rustic, old windmill that adds historic flavor to the area. Each of two large group picnic sites will contain about 20 shaded tables and large barbeque grills. Picnic sites also will be provided for smaller groups; these sites will contain ramadas with tables and cooking grills. Ramadas will be designed and situated to provide maximum privacy and to harmonize with existing contours and vegetation. Whenever necessary, plant materials will be added to provide additional shade and enhance the visual environment.

A nature interpretive area is planned southeast of the picnicking facilities in the locality of an existing mesquite bosque. Development will include trails and seating for nature interpretation and observation. Costs for the area will be shared with the Federal Government.

A recessed area northeast of the spillway saddle and adjacent to the nature interpretive area is the site for a target archery range to be cost shared with the Federal Government.

A sports area north of the dam will include paved multiuse areas and playfields. Picnic sites will be provided in a tree-shaded area adjacent to the sports facilities. A children's play area will be located nearby and will contain a variety of standard play equipment. Other picnic areas contain individual sites, as well as small group picnic areas accommodating about 25 persons. The picnic sites will be situated around turf athletic fields that could be used for informal play, as well as for organized games of hockey, soccer, or football.

Landscaping materials will be used to define spaces and to enhance the esthetic appearance of the picnic and playfield areas.

The expansive area in the center of the Adobe site will be the location of an 18-hole professional golf course, developed by the Maricopa County Parks and Recreation Department. The golf course will be part of a larger complex that will include a clubhouse, a driving range, and a nine-hole golf course in a scenic valley in adjoining Thunderbird Park.

The borrow area immediately upstream from the dam will be planted with native vegetation at flood control cost. This area will serve as a corridor for a hiking and riding trail (cost shared in its development) that will connect Thunderbird Park to the Skunk Creek landfill recreation area. Cost shared paved bicycle trails will be constructed when the sports and playfield areas are developed.

Access roads and parking facilities for the Adobe Dam recreation area will adequately accommodate park visitors. All activity areas will have conveniently located rest rooms. Maintenance equipment will be stored in a maintenance yard near the intersection of Pinnacle Peak Road and 43rd Avenue. This is also the location of an existing residence that will remain onsite as a park host facility.

A cost-shared visitor information kiosk facility is planned south of the maintenance yard and will be used to familiarize park users with the area's recreation development, flood control features, natural history, and archeology. A federally funded facility is also planned for inclusion within the basin. A petroglyph viewing site will be provided, as a part of the Cultural Resource Mitigation program, on the southeast end of the Hedgepeth Hills adjacent to the outlet works in the locality of a significant archeologic resource. This site will be the focus of a cultural resource interpretive program presently in the planning stages. A detailed description of the kiosk facility and the cultural resource interpretive program, along with cost estimates, will be included in separate documents that are forthcoming.

The Master Plan and Initial Development FDM for Adobe Dam, Design Memorandum No. 7, will present a more thorough explanation of the proposed development plan.

F. NEW RIVER DAM. While no definitive land use plan has been formulated for the New River Dam site, the Recreation Task Force has recommended the site be left in its natural state for use as a wildlife habitat area (pl. 13). In the preparation of the land use or Master Plan for New River Dam, Design Memorandum No. 8, the environmental, social and economic factors affecting uses at the damsite will be reanalyzed by the Corps of Engineers and the Recreation Task Force. This is necessary because significant changes in the aforementioned factors, especially urban growth of the surrounding lands, may alter previously proposed land uses.

Design Memorandum No. 8 will examine the need for trails and facilities for the New River Dam wildlife area.

G. ARIZONA CANAL DIVERSION CHANNEL. The proposed Arizona Canal diversion channel, which will run north of and approximately parallel to the Arizona Canal from 40th Street westward to Skunk Creek, will have three types of channels: a concrete rectangular channel, a concrete trapezoidal channel, and an unlined trapezoidal channel. The rectangular concrete channel will be a covered box in the area of the Sunnyslope High School athletic field; a concrete trapezoidal channel is planned from Cave Creek to approximately Cactus Road, an unlined trapezoidal channel will extend from Cactus Road to Skunk Creek. The Arizona Canal diversion channel will be constructed a minimum of 50 feet (15 m) north of the Arizona Canal along the canal right-of-way. The Salt River Project, operator of the canal, has agreed to allow joint use of the northern 15 feet (4.6 m) of the right-of-way as a service road for channel maintenance.

The construction of the Arizona Canal diversion channel will present a valuable opportunity to develop recreation trail systems. In a similar situation, the Maricopa County Parks and Recreation Department has already designated a trail alongside the Arizona Canal, the Sun Circle Trail.

As the interest in riding for both recreation and transportation continues to grow, the need for safe bicycle, jogging, and equestrian trails increases.

The proposed bicycle trail, which will be designed and constructed with maximum concern for safety, will not only serve recreation needs, but also will provide opportunities for pollution-free transportation. Points of interest located within immediate proximity of the proposed trail system include several public parks and recreation facilities, such as Cortez Park, Sunnyslope Swimming Pool, and Metro Center (a large shopping complex located adjacent to Black Canyon Highway).

The bicyclists and joggers will use the paved service road provided along the north side of the diversion channel. The unpaved service road along the south side of the diversion channel also will serve as a trail for equestrians and hikers. Both roads are provided at flood control cost.

Safety has been a prime consideration in the planning of the trail system (pls. 14a-d). The trails will dip into the channels at most major traffic arteries so that recreationists may travel several continuous miles without stopping for automobile traffic. A safety fence will be provided along the channel walls. Three 0.5 acre (0.20 ha) rest areas, eligible for Federal participation, will be provided along the channel at approximately 5 mile (8 km) intervals. These landscaped areas will contain watering troughs, hitching posts, bicycle

racks, picnic tables, and restrooms. The trail along the diversion channel will link with several existing and proposed city and county trails, enabling bicyclists to reach almost any portion of the metropolitan area, and equestrians to ride via the 51st Avenue county trail to Thunderbird Park and to the proposed Adobe Dam recreation area. Connecting trails through Cave Creek Regional Park will lead to the Cave Buttes Dam recreation area and to recreation areas planned along Reach 11 of Granite Reef aqueduct.

The unlined trapezoidal portion of the Arizona Canal diversion channel, from Cactus Road to Skunk Creek, will be developed as a recreation parkway; the majority of the facilities will be eligible for cost sharing. The exceptions are mentioned in the text (pl. 14d). Many activity areas are planned in the vicinity of 59th Avenue and Thunderbird Road. Picnic facilities will be located near small lagoons that may be used for casting practice and sailing of model boats while functioning as energy dissipators. A children's play area will be located nearby. A portion of the relocated Arizona Canal is being considered as the site for a potential canoeing and rowing course, to be developed without Federal participation. A paved multiuse--game area--as well a retirement recreation area (local cost) with facilities for shuffleboard, horseshoes, and patio games--also is planned. Athletic fields will accommodate football, baseball, field hockey, and soccer games. Local interests will construct a bicyclists' hostel and information building.

Equestrian activities, very popular in the Glendale area, will be provided for in the parkway in the vicinity of 67th Avenue. This area will contain an equestrian training area and an open riding area. A grassy area may be used for horse grooming and exercising, informal riding competition, and for organized activities such as 4-H club meetings.

The westernmost part of the parkway and the confluence of the diversion channel and Skunk Creek will be designated a Natural Resources Appreciation Area. Existing vegetation will be augmented by the planting of selected species. The channel widens at the confluence, and additional vegetation in this area will be useful in slowing down the rate of stormwater flows. Field archery facilities will be located in this area.

Trails for bicyclists, equestrians, hikers, and joggers will continue west from Cactus Road through the parkway. Rest room facilities will be conveniently located throughout the recreation area. Trails and rest room facilities will be cost shared. The local interests are also proposing development of a people-mover system.

The landscaping plan for the parkway will be consistent with the hydraulic requirements and will be included as a flood control cost. Low-density planting, established on the slopes of the parkway and in selected areas of the channel invert, will provide shade and esthetic variety to the recreation areas.

Refinement of the concepts and uses along the Arizona Canal diversion channel will be presented in Design Memorandum No. 3, Part 5.

H. SKUNK CREEK AND THE NEW AND AGUA FRIA RIVERS. The flowage easements along Skunk Creek and the New and Agua Fria Rivers will be developed into approximately 20 mi (32 km) of hiking and riding trails (pl. 15). A hard dirt trail, indicated by a sign, will provide safe recreation opportunities for hikers, joggers, and equestrians. Three landscaped rest stops and staging areas--with rest rooms, picnic tables, hitching posts, and watering troughs--will be provided in convenient locations along the trails. All proposed development in this area is cost sharable with the Federal Government.

Additional analysis and planning will be addressed in Design Memorandum No. 3, Part 5.

I. JUSTIFICATION. Part of the justification of recreation development depends on the fact that the existing demand within the market area is greater than the supply. For each of the recreation projects the total unmet demand greatly exceeds the project supply. The figures in table 4 represent the totals for all of the activities proposed at each project.

Columns 1 and 2 display, respectively, the present demand for recreation and the existing supply of recreation. Column 3 reflects the unmet demand for recreation (the difference between columns 1 and 2). Column 4 represents the supply of recreation days to be furnished by the proposed recreation plans.

Supply and demand figures are in recreation days. One recreation day represents one person recreating for all or any part of a 24-hr day.

A monetary value was assigned to each recreation experience based on the criteria for evaluation and the values in the 1979 Principles and Standards (P&S) updated to the 1980 price level. For example, picnicking at Adobe Dam Phase I was given a value of \$2.58 per experience. The values assigned to each type of activity when multiplied times the number of experiences (the number of annual recreation days) provided by the project for that particular activity yields the benefit, in monetary terms, that can be assigned to recreation. The total recreation benefit when compared to the total recreation first cost produces the recreation benefit to cost ratio.

For the purposes of Corps economic analysis the project must attain a benefit cost (B/C) ratio of at least unity (benefits equalling costs). In the case of the four Phoenix and Vicinity (including New River) projects the B/C ratios range from 1.4 to 4.1 (benefits exceeding project costs) at 3-1/4% interest rate. Additional analysis is included in the economic appendix.

Table 4. Recreation Day Supply and Demand Totals (Rounded).

Item	Present Demand	Existing Supply	Unmet Demand	Project Supply
Dreamy Draw	20,741,500	13,660,500	7,081,000	89,500
Cave Buttes	38,381,000	9,520,000	28,861,000	453,000
Adobe ¹	112,237,000	9,595,000	60,636,000	537,000
Arizona ¹ Canal diversion channel	93,900,000	7,291,000	38,639,000	468,500

Each of the individual Master Plans outlined in this report will present a thorough, comprehensive plan of development concepts and any modifications thereof. FDMs will detail the specific numbers and locations of the facilities. All proposed development will occur within project boundaries, unless otherwise stated within the master plan. The demand for the recreation opportunities recommended within these plans will still exceed the supply in the market area. The local recreation sponsor will share in the development and the implementation of plans with the Corps, then will operate and maintain the facilities, upon completion.

¹ Existing supply was not qualified for all of the activities at these sites. Unmet demand reflects only those activities where Existing Supply was calculated. See the economic appendix for details.

Chapter 12

SPECIAL PROBLEMS

Special problems or elements of concern in planning, designing, and constructing recreation facilities within the project features require consideration. Some of the problems are identified below.

A. SCHEDULING FACTORS. Preparation of resource use master plans is dependent on necessary engineering information provided in the FDMs for flood control features.

Scheduling of recreation facility construction hinges on availability of local funds from cost sharing sponsors.

B. POSSIBLE CONSTRUCTION CONFLICTS. If construction of recreation facilities is initiated during construction of flood control features, efforts must be made to avoid conflicts that may arise when two contractors are working in the same area. Conflicts may result from sequence of construction and areas planned for multiple uses, such as borrow areas where recreation development is planned.

C. NECESSARY ACQUISITIONS. Before recreation facilities can be constructed at the detention basins and along Skunk Creek and the New and Agua Fria Rivers, the local recreation sponsor must enter into an agreement with the local flood control sponsor authorizing use of the lands for compatible recreation purposes. The sponsors for recreation development will acquire recreation easements or fee title to any lands required for recreation that are not acquired in fee title by the local sponsor for flood control purposes. Every effort will be made to enter into agreements with durations equal to or greater than the economic life of the flood control features. To protect recreation facilities developed on leased lands, a clause that prohibits landowners from altering or destroying landscaping or facilities will be included in the lease agreement.

D. PRESERVATION OF NATURAL HABITAT. Sand and gravel operations at Cave Buttes Dam and Adobe Dam have destroyed natural habitat and scarred the landscape. Should these operations expand to other parts of the reservoirs, more and more of the landscape would be highly disturbed; this, in turn, could affect the location of planned recreation facilities. Extensive landscaping and many years would be required to revitalize and beautify these destroyed areas.

E. BORROW AREAS. The areal extent and depth of the borrow areas will influence recreation development within and adjacent to these areas. Recreation development plans may need to be modified to better accommodate the completed borrow areas.

F. ARCHEOLOGIC CONSIDERATIONS. Master plans for each of the project features must take into consideration the archeologic sensitivity of sites within the project boundaries. Land use planning for each of these areas must be coordinated with archeologic interests in order to either attract visitors to specific sites for educational purposes or discourage certain uses for resource protection.

G. POSSIBLE INUNDATION. Because the recreation facilities in the reservoirs will sustain some damage during periods of flooding and inundation, the final planning and design of recreation facilities in the reservoir will include consideration of the possibility of inundation. The design details will be discussed in forthcoming master plans.

H. SPECIAL POPULATIONS. Many special populations, such as senior citizens and the physically handicapped, locate within the Phoenix metropolitan area because of the warm, dry climate. The planning and design of recreation development associated with the project not only will accommodate, but will encourage, use by these special populations. Specific plans and criteria for design of facilities will be outlined in the individual master plans and detailed in the recreation FDM.

I. NIGHT LIGHTING. Arizona is noted for its hot, dry desert climate. Because temperatures reach into the range of 100° F (37.3° C) during the summer days, but cool off during the nights, maximum recreation use extends from dusk well into the hours after dark. Consequently, provisions will be made for night lighting, both for night recreation use and for a security patrol program.

J. ALTERNATIVE WATER SOURCE. It is planned that water for Cave Creek Regional Park will come from the Granite Reef aqueduct of the Central Arizona Project. The Arizona Water Commission has assured the recreation task force that plans for the Granite Reef aqueduct are materializing as scheduled, and there is virtually no need for concern that the project will not be completed. Despite such assurance, however, a great deal of controversy surrounds the Central Arizona Project. If Granite Reef aqueduct is not constructed, water for Cave Creek Regional Park could be obtained by drilling additional wells in the wash area.

K. WATER CONSERVATION. Because Arizona is an arid region, water conservation will be taken into consideration and discussed during the detailed planning of each project.

L. ALINEMENT PLANS. Urban development has penetrated many areas adjacent to the Arizona Canal. The proposed alinement of the diversion channel passes through two city parks, the Sunnyslope High School and Arroyo Elementary School athletic fields, the Arizona Biltmore Estate, some businesses, and many private homes. As plans for the alinement of

the channel become refined, new recreation resources might be identified. Also, adjustment will be made of the plans proposed in the Master Plan for the Arizona Canal diversion channel to take advantage of any new opportunities that become available.

M. EXISTING RECREATION FACILITIES. Plans for recreation development have been coordinated with existing and proposed recreation facilities within the project area. Along the Arizona Canal an unavoidable, but easily resolved, conflict in plans occurred. In 1976, the City of Phoenix, with funds granted from the U.S. Bureau of Outdoor Recreation (now Heritage Conservation and Recreation Service), constructed a 6-mi (10-km) bicycle path along the northern 10 ft (3 m) of the Arizona Canal right-of-way. This bikeway is heavily used by bicyclists and joggers. Although construction of the Arizona Canal diversion channel will destroy the bike path, a paved maintenance road will be provided along the northern side of the diversion channel as part of the flood control costs. This maintenance road also will serve as a replacement trail for the bicyclists and joggers.

Chapter 14

DEPARTURE FROM PREVIOUSLY APPROVED PLANS: COMPARISON OF COSTS AND COST APPORTIONMENT

A. GENERAL. The estimated first costs for recreation development at each of the New River and Phoenix City Streams project features include the costs arrived at from review of the Phase I GDM, PB-3 1980, and present (October 1980) estimates. The figures represent the total expected cost-shared recreation development costs, excluding the solely non-Federal development costs. The purpose of this section is to account for modifications in the Phase I estimated costs, as compared with the PB-3 and present estimates. The apportionment of first costs between Federal and non-Federal interests is also discussed.

B. COMPARISON OF PHASE I ESTIMATES WITH PB-3 ESTIMATES. The Phase I estimates, completed in October 1975 and presented in the New River and Phoenix City Streams General Design Memorandum - Plan Formulation (GDM), were subsequently reviewed and modified. These preliminary calculations were designed to assess costs for Federal and non-Federal entities cost sharing in recreation development at each of the features. In a review, modifications of these estimates were made to reflect the proper distribution of costs between cost sharable and non-cost sharable items. The revised costs are presented in table 5. Phase I figures reflect preparatory recreation planning efforts.

The PB-3 figures demonstrate the application of price leveling on the revised Phase I GDM cost, and an increased E&D and S&A cost to study an expanded recreation plan.

C. COMPARISON OF PRESENT ESTIMATES WITH PB-3 ESTIMATES. The changes in the present (July 1980) estimated first costs, as compared with the PB-3 estimates shown on table 5, are explained in the following paragraphs.

1. Overall Master Plan. An increase of \$273,000 is a result of the long duration of the planning effort during the development of the various separate projects and is a result of the costs for revisions and reprinting.

2. Master Plans. The PB-3 estimate reflects only the cost for the Overall Master Plan, DM No. 4. Separate master plans for each project were not considered in the project costs. The present estimate includes the costs for master plan development for Dreamy Draw, Cave Buttes, Adobe, and New River dams, in addition to the Overall Master Plan costs. The present estimates reflect the amount spent to date as separate line items and an estimate of the amount required to complete the document.

3. Dreamy Draw Dam. An increase of \$619,500 is a result of \$501,500 in increased first costs due to the expansion of the recreation plan and \$118,000 in Master Plan costs not previously accounted for.

4. Caves Buttes Dam. An increase of \$3,678,000 is a result of \$3,204,000 in increased first costs due to the expansion of the recreation plan, \$405,000 in resultant increased engineering and design and supervision and administration costs and \$69,000 in Master Plan costs previously unaccounted for.

5. Adobe Dam. A decrease of \$1,828,000 is a result of \$1,696,000 in decreased first costs due to a lessened estimated quantity of items to be provided for the proposed recreation facilities, \$234,000 in resultant decreased engineering and design, and supervision and administration costs and a \$102,000 increase in Master Plan costs previously unaccounted for.

6. New River Dam. A decrease of \$43,000 is a result of the elimination of \$70,000 in engineering and design, and supervision and administration costs and the addition of \$27,000 in Master Plan costs. The decrease is due to a change in the level of the land use planning proposed for the New River Dam basin.

7. Arizona Canal Diversion Channel (Cactus Rd. to Skunk Creek). An increase of \$598,000 is due to \$422,000 in increased first costs to cover an expanded recreation plan on the Cactus Rd. to Skunk Creek reach and \$176,000 in increased engineering and design, and supervision and administration costs.

8. Cave Creek Regional Park. A Corps policy has not been formulated on the eligibility of nonstructural flood control features for recreation development. Consequently, Cave Creek Regional Park cost estimates have been deleted until a firm policy is established.

9. ACDC (Dreamy Draw to Cactus Rd.) and Skunk Creek, New and Agua Fria Rivers. There has been no change from the PB-3 estimates to the present estimates.

D. COST APPORTIONMENT.

Table 5 also presents the Federal and non-Federal contributions toward the recreation first costs. Apportionment of costs for recreation features determined eligible for cost sharing is 50% Federal and 50% non-Federal. An exception to this apportionment is the wildlife pond included in the Phase I Cave Buttes Plan and the wildlife half of the Phase II Cave Buttes lake, which are not recreation features. These features are considered fish and wildlife enhancement and are to be 75% Federal cost and 25% local costs.

Table 5 footnote 1 breaks out the Federal and non-Federal portions of the two proposed lakes. These amounts and the difference in engineering and design, and supervision and administration costs for Cave Buttes explain the discrepancy between the Federal and the non-Federal costs.

The Phase I General Design Memorandum total reflects the cost borne by the Federal Government in the preparation of a recreation appendix and EIS for the basic flood control document.

Preparation of a Recreation Master Plan for each of the projects is borne by the Federal Government.

Table 6 shows the cost apportionment between Federal and non-Federal interests for the entire project at the July 1980 price level. The cost agreement, Appendix 3, was approved in form by the Office of the Chief of Engineers during review of the Phase I GDM in July of 1977.

Table 5. Recreation First Costs (Rounded)

Item	Phase I October 1975			PB-3 October 1980		
	Federal	Non Federal	Total	Federal	Non Federal	Total
Overall Master Plan	100,000	0	100,000	35,000	0	35,000
Dreamy Draw Recreation	167,000	167,000	334,000	257,000	257,000	514,000
E & D	16,500	16,500	33,000	81,000	81,000	162,000
S & A	16,500	16,500	33,000	40,000	40,000	80,000
Master Plan	0	0	0	0	0	0
TOTAL	200,000	200,000	400,000	378,000	378,000	756,000
Cave Buttes Dam Recreation ¹	224,000	224,000	448,000	344,000	344,000	688,000
E & D	23,000	23,000	46,000	154,000	154,000	308,000
S & A	23,000	23,000	46,000	52,000	52,000	104,000
Master Plan	0	0	0	0	0	0
TOTAL	270,000	270,000	540,000	550,000	550,000	1,100,000
Adobe Dam Recreation	1,350,000	1,350,000	2,700,000	2,290,000	2,290,000	4,580,000
E & D	137,500	137,500	275,000	197,000	197,000	394,000
S & A	137,500	137,500	275,000	223,000	223,000	446,000
Master Plan	0	0	0	0	0	0
TOTAL	1,625,000	1,625,000	3,250,000	2,710,000	2,710,000	5,420,000
New River Dam Recreation	0	0	0	0	0	0
E & D	0	0	0	29,000	29,000	58,000
S & A	0	0	0	6,000	6,000	12,000
Master Plan	0	0	0	0	0	0
TOTAL	0	0	0	35,000	35,000	70,000
ACDC (Dreamy Draw to Cactus Rd ²)	724,500	724,500	1,449,000	1,244,000	1,244,000	2,488,000
E & D	74,000	74,000	148,000	120,000	120,000	240,000
S & A	73,500	73,500	147,000	120,000	120,000	240,000
Master Plan	0	0	0	0	0	0
TOTAL	872,000	872,000	1,744,000	1,484,500	1,484,500	2,969,000

- Includes wildlife pond and recreation/wildlife lake non-recreation cost accounts:
 Phase I Pond: \$204,900 Federal (75%)
 68,300 Local (25%)
 Phase II Lake: \$384,000 Federal (75% of
 wildlife half)
 \$807,000 Local (25% of
 wildlife half plus
 100% of recreation
 half)
- Includes Cave Creek channel Peoria Ave. to the Arizona Canal diversion channel
- The local sponsor will be responsible for acquiring in fee title or in recreation easement those lands required for recreation development, if any, that are not a part of the flood control acquisition

Table 5. Recreation First Costs (Rounded)

1975	PB-3 October 1980				Present July 1980		
	Total	Federal	Non Federal	Total	Federal	Non Federal	Total
	100,000	35,000	0	35,000	308,000	0	308,000
	334,000	257,000	257,000	514,000	507,750	507,750	1,015,500
	33,000	81,000	81,000	162,000	81,000	81,000	162,000
	33,000	40,000	40,000	80,000	40,000	40,000	80,000
	0	0	0	0	118,000	0	118,000
	400,000	378,000	378,000	756,000	746,750	628,750	1,375,500
	448,000	344,000	344,000	688,000	1,853,000	2,039,000	3,892,000
	46,000	154,000	154,000	308,000	278,000	306,000	584,000
	46,000	52,000	52,000	104,000	111,000	122,000	233,000
	0	0	0	0	69,000	0	69,000
	540,000	550,000	550,000	1,100,000	2,311,000	2,467,000	4,778,000
	2,700,000	2,290,000	2,290,000	4,580,000	1,442,000	1,442,000	2,884,000
	275,000	197,000	197,000	394,000	216,500	216,500	433,000
	275,000	223,000	223,000	446,000	86,500	86,500	173,000
	0	0	0	0	102,000	0	102,000
	3,250,000	2,710,000	2,710,000	5,420,000	1,847,000	1,745,000	3,592,000
	0	0	0	0	0	0	0
	0	29,000	29,000	58,000	0	0	0
	0	6,000	6,000	12,000	0	0	0
	0	0	0	0	27,000	0	27,000
	0	35,000	35,000	70,000	27,000	0	27,000
	1,449,000	1,244,000	1,244,000	2,488,000	1,244,000	1,244,000	2,488,000
	148,000	120,000	120,000	241,000	120,500	120,500	241,000
	147,000	120,000	120,000	240,000	120,000	120,000	240,000
	0	0	0	0	0	0	0
	1,744,000	1,484,500	1,484,500	2,969,000	1,484,500	1,484,500	2,969,000

lake non-recreation cost accounts:

se I Pond: \$204,900 Federal (75%)

68,300 Local (25%)

se II Lake: \$384,000 Federal (75% of
wildlife half)\$807,000 Local (25% of
wildlife half plus
100% of recreation
half)

Arizona Canal diversion channel

iring in fee title or in recreation

velopment, if any, that are not a

Table 5. Recreation First Costs (Continued)

Item	Phase I October 1975			PB-3 October 1980		
	Federal	Non Federal	Total	Federal	Non Federal	Total
ACDC (Cactus Rd. to Skunk Creek)	1,050,000	1,050,000	2,100,000	1,742,500	1,742,500	3,485,000
E & D	107,500	107,500	215,000	161,000	161,000	322,000
S & A	107,500	105,500	215,000	161,000	161,000	322,000
TOTAL	1,265,000	1,265,000	2,530,000	2,064,500	2,064,500	4,129,000
Skunk Creek, New and Agua Fria Rivers (Flowage Easements)	144,000	144,000	288,000	221,500	221,500	443,000
E & D	14,500	14,500	29,000	21,000	21,000	42,000
S & A	14,500	14,500	29,000	21,000	21,000	42,000
TOTAL	173,000	173,000	346,000	263,500	263,500	527,000
Cave Creek Reg. Park	3,582,500	3,582,500	7,165,000	0	0	0
E & D	359,000	359,000	718,000	0	0	0
S & A	358,500	358,500	717,000	0	0	0
TOTAL	4,300,000	4,300,000	8,600,000	0	0	0
Phase I GDM E & D	570,000	0	570,000	570,000	0	570,000
Lands ³						
ACDC	0			0		
Skunk Crk, New & Agua Fria Rivers	0			0		
TOTAL	0			0		

- Includes wildlife pond and recreation/wildlife lake non-recreation cost accounts:

Phase I Pond:	\$204,900 (Federal 75%)
	68,300 (Non-Federal 25%)
Phase II Lake:	\$384,000 (Federal 75% of wildlife half)
	\$807,000 (Non-Federal 25% of wildlife half plus 100% of recreation)
- Includes Cave Creek channel Peoria Avenue to ACDC
- The local sponsor will be responsible for acquiring in fee title or in recreation easement those lands required for recreation development, if any, that are not a part of the flood control acquisition.

Table 5. Recreation First Costs (Continued)

October 1975		PB-3 October 1980			Present July 1980		
General	Total	Federal	Non Federal	Total	Federal	Non Federal	Total
000	2,100,000	1,742,500	1,742,500	3,485,000	1,953,500	1,953,500	3,907,000
500	215,000	161,000	161,000	322,000	293,000	293,000	586,000
500	215,000	161,000	161,000	322,000	117,000	117,000	234,000
000	2,530,000	2,064,500	2,064,500	4,129,000	2,363,500	2,363,500	4,727,000
000	288,000	221,500	221,500	443,000	221,500	221,500	443,000
500	29,000	21,000	21,000	42,000	21,000	21,000	42,000
500	29,000	21,000	21,000	42,000	21,000	21,000	42,000
000	346,000	263,500	263,500	527,000	263,500	263,500	527,000
500	7,165,000	0	0	0	0	0	0
000	718,000	0	0	0	0	0	0
500	717,000	0	0	0	0	0	0
000	8,600,000	0	0	0	0	0	0
0	570,000	570,000	0	570,000	570,000	0	570,000
		0			0	0	0
		0			0	0	0
		0			0	0	0

Wildlife lake non-recreation

Phase I Pond: \$204,900 (Federal 75%)

68,300 (Non-Federal 25%)

Phase II Lake: \$384,000 (Federal 75% of wildlife half)

\$807,000 (Non-Federal 25% of wildlife)

half plus 100% of recreation half)

to ACDC

acquiring in fee title or in recreation

development, if any, that are not

Table 6. Cost Apportionment - Entire Project

<u>Item</u>	<u>Dollars (rounded)</u>
Federal	
Construction	8,727,000
Non-apportionable planning (Master Plan and Phase I GDM Costs)	1,194,000
Total	<u>9,921,000</u>
Non-Federal	
Construction	<u>8,952,000</u>
Total Project	<u>18,873,000</u>

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Chapter 1

INTRODUCTION

A. PROJECT AUTHORIZATION. The New River and Phoenix City Streams project, also known as the Phoenix, Arizona, and Vicinity (including New River) project, was authorized by the Flood Control Act of 1965 (Public Law 89-298), approved 27 October 1965. Section 4 of the Flood Control Act of 1944, as amended by Section 207 of the Flood Control Act of 1962, made it possible for the Corps to construct, maintain, and operate public parks and recreation facilities at water resource development projects. The law also permits the Corps to authorize local interests to construct, maintain, and operate recreation facilities.

B. PROJECT PURPOSE. The authorized purpose of the project is to provide flood protection to residential, commercial, industrial, agricultural, and public and semipublic lands within the Phoenix metropolitan area (pl. 1). As a result of comments by the Board of Engineers for Rivers and Harbors, recreation development was investigated and determined to be economically justified and therefore included as a project purpose. After that determination, the board, in cooperation with appropriate State and Federal agencies, recommended the proposed detention basins be modified to include fish and wildlife enhancement, as well as recreation facilities (pl. 2).

C. PURPOSES OF OVERALL MASTER PLAN. The primary purposes of this report are: (1) to provide a basis for understanding the factors influencing development and the intervening relationships among the resources and recreation features at the New River and Phoenix City Streams project, and (2) to tie together the proposed separate master plans for each of the project features into a comprehensive recreation system.

D. SCOPE OF OVERALL MASTER PLAN. The scope of this report provides a general overview of flood control features, recreation features, land use plans, time schedules, cost estimates, project management, and factors (environmental, social, and economic) affecting resource development within the Phoenix metropolitan area. Subsequent to this report, four master plans and one feature design memorandum (FDM) resource use appendix will be prepared for separate features of the project; these plans will include more detailed accounts of the resources and recreation development planning.

E. FUTURE MASTER PLANS. The recreation master plans will be presented as four separate documents; each will be devoted to the recreation features of one of the flood control projects. This method of presentation was selected because it is unlikely that each of the projects will have the same recreation sponsor. Differing sponsors will require distinct cost sharing agreements, as well as distinct planning

and design activities, for essential coordination on each project. These smaller-sized documents can be more easily understood, distributed, and analyzed by the local sponsors.

One of the individual recreation master plans and the FDM resource use appendix will combine development features at sites that are mutually dependent: (a) Cave Buttes Dam area and Cave Creek Regional Park, and (b) Arizona Canal diversion channel and Skunk Creek, and the New and Agua Fria Rivers. The combining of these complementary features will result in a savings of time and money, yet still present a cohesive and usable plan for local recreation sponsors.

In most cases, the master plans and initial development FDMs will be presented as one document. The master plan will embody the conceptual land uses based on environmental, social, and economic investigations presented in the environmental impact statement (EIS) and delineated in the text for the study area. Factors influencing development are described within the text and are the basis for the recommended recreation site development plan. The master plan precedes the FDM and furnishes the basic concepts, plans, and support needed to complete the FDM.

The portion of the report devoted to the initial development FDM will provide the necessary detailed information required for preparation of plans and specifications. In the case of a phased recreation development plan, such as Cave Buttes, a separate FDM for future development may be produced. In initial development, shortly after completion of the flood control project, fewer recreation features will be available. As residential development occurs, future development of more urban-oriented recreation opportunities will be implemented.

Some elements of the master plan will be periodically updated, as required by perceived or real needs of the local recreation sponsor and the community. The FDM then will be revised to reflect these modifications.

The Dreamy Draw, Cave Buttes, and Adobe Dam projects will have the master plan and initial development FDM combined. The New River Dam project will be produced as a master plan only. Arizona Canal diversion channel and Skunk Creek, and New and Agua Fria Rivers will be included in the Arizona Canal diversion channel flood control FDM as a recreation appendix.

F. FUTURE PERTINENT REPORTS. Following is a list of resource use related design memoranda scheduled for future issuance and a brief statement describing the content of each.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 5,
Master Plan and Feature Design for Recreation,
Dreamy Draw Dam.

Sept. 1980

The master plan will analyze the resources of the area, describe a specific plan for recreation development, and provide the basis for the preparation of plans and specifications.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 6,
Master Plan and Initial Development Feature
Design Memorandum, Cave Buttes Dam

Feb. 1981

The master plan will describe the resources of the area and their effect on developing a land use plan for the basin, discuss the recommended land uses and their general location, and include the development plan for Cave Creek Regional Park, previously prepared by the City of Phoenix and the Corps of Engineers. This report will also detail the specific types, numbers, and locations of recreation facilities to be developed under the Initial Development Feature Design Memorandum.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 7,
Master Plan and Initial Development Feature Design
Memorandum, Adobe Dam

Mar. 1981

The master plan will describe the resources of the area and their effect on developing a land use plan for the basin, show the relationship of the contiguous Thunderbird Park, and outline a comprehensive land use plan within the project boundaries. This report will also detail the specific types, numbers, and locations of recreation facilities to be developed under the Initial Development Feature Design Memorandum.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 8
Master Plan, New River Dam

July 1982

The master plan will describe the resources of the area and their effect on developing a land use plan for the basin and outline a comprehensive land use plan within the project boundaries.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 9, Future Development
Feature Design Memorandum, Cave Buttes Dam

Sept. 1983

The feature design will detail the specific types, numbers, and locations of recreation facilities to be developed under the Future Development Feature Design Memorandum. This document will provide the basis for preparation of project plans and specifications.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 10, Feature Design
Memorandum, New River Dam

July 1985

The feature design will detail the specific types, numbers, and locations of recreation facilities to be developed within the basin. This document will provide the basis for preparation of project plans and specifications.

New River and Phoenix City Streams, Arizona,
Design Memorandum No. 11, Future Development
Feature Design Memorandum, Adobe Dam

Sept. 1989

The feature design will detail the specific types, numbers, and locations of recreation facilities to be developed under the Future Development Feature Design Memorandum. This document will provide the basis for preparation of project plans and specifications.

G. PRIOR PERTINENT REPORTS. A list of previously issued design memoranda appears in the front matter of this report. Some of those reports, plus others applicable to the overall development of the New River and Phoenix City Streams features, are listed below:

New River and Phoenix City Streams, Arizona
Design Memorandum No. 1,
Feature Design for Dreamy Draw Dam

Jan. 1972

Final Environmental Impact Statement,
Dreamy Draw Dam, Maricopa County, Arizona

Mar. 1972

Final Environmental Impact Statement,
New River and Phoenix City Streams
Maricopa County, Arizona

Mar. 1976

New River and Phoenix City Streams, Arizona
Design Memorandum No. 3,
General Design Memorandum--Phase I
Plan Formulation Mar. 1976

New River and Phoenix City Streams, Arizona
Design Memorandum No. 3,
General Design Memorandum--Phase II,
Project Design--Part I, Cave Buttes Dam
(including Cave Creek to Peoria Avenue) July 1976

An Archeological Survey in the Gila River Basin
New River and Phoenix City Streams, Arizona,
Project Area 1976

Amplification to the Final Environmental Impact
Statement, New River and Phoenix City Streams
Flood Control Project, Maricopa County, Arizona,
Preservation of Cave Creek Dam Dec. 1977

New River and Phoenix City Streams, Arizona
Design Memorandum No. 3,
General Design Memorandum--Phase II
Project Design--Part 2, Adobe Dam
(including Skunk Creek to the Arizona Canal) Apr. 1979

Other publications used as guides in the preparation of the overall
master plan for the New River and Phoenix City Streams project are
listed below.

The Park and Recreation Plan, Phoenix, Arizona,
Parks and Recreation Board and Planning
Commission, City of Phoenix June 1969

The Park and Recreation Plan, Summary, Phoenix,
Arizona, Parks and Recreation Board and Planning
Commission, City of Phoenix July 1970

Recreational Planning, Development, and Management
Policies (ER 1165-2-400),
Office of the Chief of Engineers, Department
of the Army Aug. 1970

Federal Participation in Recreational Development
(EC 1120-2-404),
Office of the Chief of Engineers, Department
of the Army Aug. 1970

A Park, Recreation, and Open Space Study,
Maricopa County Planning and Zoning Department,
Maricopa Association of Governments Sept. 1970

State of Arizona, Statewide Comprehensive Outdoor Recreation Plan, Arizona Outdoor Recreation Coordinating Commission	1970
Environmental Quality in Design of Civil Works Projects (EM 1110-2-38), Office of the Chief of Engineers, Department of the Army	May 1971
Recreation Planning and Design Criteria (EM 1110-2-400), Office of the Chief of Engineers, Department of the Army	Sept. 1971
Recreation Resources Planning (ER 1120-2-400) Office of the Chief of Engineers	Nov. 1971
An Open Space Plan for the Phoenix Mountains, City of Phoenix	Jan. 1972
Design of Recreation Sites, Areas and Facilities (ER 1110-2-400), Office of the Chief of Engineers, Department of the Army	Sept. 1974
Principles Governing Financial Participation by the Corps of Engineers in Recreation Development of Local Flood Control Projects, Office of the Chief of Engineers, Department of the Army	June 1976
Arizona Statewide Comprehensive Outdoor Recreation Plan, Arizona Outdoor Recreation Coordinating Commission	Jan. 1978
Resource Use: Establishment of Objectives (ER 1105-2-167), Office of the Chief of Engineers, Department of the Army	Apr. 1978
Environmental Quality: Policy and Procedures for Implementing the National Environmental Policy Act (NEPA) (ER 200-2-2) 33 CFR part 230	Aug. 1980

H. REFERENCES. The following references were used in the New River and Phoenix City Streams project.

Arizona Climate, Ed. William D. Sellers and Richard H. Hill, Tucson, Arizona, U. of Arizona Press, 1974.

Arizona Republic and Phoenix Gazette, Inside Phoenix 1978, Phoenix, Arizona, Phoenix Newspapers, Inc. 1978.

Arizona State University, An Archeological Survey of the Cave Buttes Dam Alternative Site and Reservoir, Arizona, Anthropological Research Paper No. 8, by James B. Rogers, with Appendix by Donald E. Weaver, Jr., Department of Anthropology, Tempe, Arizona, 1974.

Demaree, Salome R., Eleanor L. Radke, and Janet L. Witzeman: Annotated Field List, Birds of Maricopa County, Arizona, Phoenix, Arizona, Maricopa Audubon Society, 1972.

Elements of Outdoor Recreation Planning, Ed., B.L. Driver, and Ann Arbor, U. of Michigan, Press, 1970.

Maslow, Abraham H.: Motivation and Personality, New York, Harper and Row, 1954.

Thiele, Heinbrich J.: Present and Future Water Use and Its Effect on Planning in Maricopa County, Arizona, (Phoenix, Arizona) Maricopa County Board of Supervisors and the Maricopa County Planning and Zoning Dept., September 1965.

U.S. Department of Agriculture, Soil Conservation Service, General Soil Map, Maricopa County, Arizona, Washington, D.C., U.S. Government Printing Office, 1969.

U.S. Government Printing Office, House Document No. 94-51, 94th Congress, 1st Session, Serial No. 94-A, Report on Endangered and Threatened Plant Species of the United States, Washington, D.C. 1975.

Valley National Bank of Arizona, Arizona Statistical Review, Phoenix, Arizona, Economic Research Dept., Valley National Bank, 34th Edition, 1978.

I. APPLICABILITY OF SELECTED PUBLIC LAWS. The following laws provide guidance for the development and management of Federal projects for various purposes according to the intent of Congress and as they apply to the New River and Phoenix City Streams Project:

a. Section 4, Public Law 78-534 (The Flood Control Act of 1944), as amended, authorizes the Corps of Engineers to construct, maintain, and operate public park and recreation facilities at water resource development projects and to permit local interests to construct, maintain, and operate such facilities.

b. Public Law 85-624 (The Fish and Wildlife Coordination Act of 1958) provides for the integration of fish and wildlife conservation in water resources projects. The U.S. Fish and Wildlife Service has prepared a report, dated 1 February 1978, pertaining to the fish and wildlife resources of the project area. The recommendations and findings contained in the report have been given full consideration. Coordination with related State and Federal agencies was maintained during the development of this master plan.

c. Public Law 89-72 (The Federal Water Project Recreation Act of 1965), accompanied by House Committee Report 254, requires that the project provide for outdoor recreation and for fish and wildlife enhancement. It also provides for non-Federal participation in land acquisition and in the development and management of recreation facilities and fish and wildlife resources.

d. Section 204, Public Law 89-298 (The Flood Control Act of 1965) authorizes the Corps of Engineers to construct the New River and Phoenix City Streams Flood Control Project for flood protection in Phoenix, Arizona, and vicinity.

e. Public Law 91-190 (The National Environmental Policy Act of 1969) requires that the environmental effects of each project and the means and measures to minimize any adverse effects be evaluated and presented in an EIS. The EIS for the New River and Phoenix City Streams project addresses the impact of recreation development associated with the project. These impacts have been considered in the development of land use plans for the project areas.

Project Description

Chapter 2

PROJECT DESCRIPTION

A. **PROJECT LOCATION.** The project area lies in and near the Phoenix metropolitan area in the northeastern portion of Maricopa County. It is a valley region, characterized by rugged mountains and broad intermountain alluvial plains, that lies south and east of the Hieroglyphic Mountains. Cave Creek and Skunk Creek, and the New and Agua Fria Rivers cross the valley. The Agua Fria River flows into the Gila River, which forms the southern boundary of the project area.

B. **PROJECT FEATURES.** Four dams are included as features of the recommended plan. Dreamy Draw and Cave Buttes Dams are completed, and Adobe and New River Dams are proposed. Each completed dam has been designed and each proposed dam will be designed to provide standard project flood storage. Hydrological data facilities are included at each dam. A reservoir water surface recording gage, reservoir staff gages, and a precipitation station have been installed at Dreamy Draw Dam. All the above named facilities, as well as sedimentation ranges and an outflow gauging station, also will be installed at Cave Buttes, Adobe, and New River Dams.

1. **Dreamy Draw Dam.** Dreamy Draw Dam is located in Dreamy Draw just south of Northern Avenue and 1 mi east of 16th Street. The main embankment, as constructed, is a zoned compacted earthfill structure with a maximum height of about 50 ft (15 m) above the streambed. The unlined spillway is excavated in rock about 400 ft (122 m) southeast of the left abutment of the main embankment and has a concrete sill 100 ft (30 m) in length at elevation 1405 ft (428 m). The spillway is designed to pass a spillway-design flood having a peak discharge of 7000 ft³/s (198 m³/s) with 5 ft (1.5 m) of freeboard. The outlet consists of a 3-ft (0.9-m) diameter ungated reinforced concrete conduit located in the main embankment. The capacity of the outlet is about 220 ft³/s (6.2 m³/s) with the water surface at the spillway crest. A zoned compacted earthfill saddle-dike, about 1060 ft (323 m) in length and 20 ft (6 m) in maximum height, crosses the saddle between the right abutment of the dam and Northern Avenue. The detention basin has a capacity of 317 acre-ft (39 ha-m) at the spillway crest, of which 36 acre-ft (4.4 ha-m) is for the accumulation of sediment over a 100-year period. The detention basin will reduce a standard project flood with a peak inflow of 3600 ft³/s (102 m³/s) to an outflow of about 220 ft³/s (6.2 m³/s).

2. **Cave Buttes Dam.** Cave Buttes Dam, with three dikes, is located about 0.7 mi (1.1 km) downstream (south) from the existing Cave Creek Dam. Cave Creek Dam, originally slated for demolition, is now recommended to remain in place. A bypass channel will convey floodwaters around Cave Creek Dam to preclude overtopping and possible dam failure. Cave Buttes Dam is a zoned compacted earthfill structure

about 109 ft (33 m) in maximum height above streambed. The crest of the dam will be about 2275 ft (693 m) in length at elevation 1679.1 ft (511.8 m), excluding settlement allowance. The unlined spillway, excavated in rock about 1600 ft (488 m) west of the west (right) abutment of the main embankment, has a concrete sill 510 ft (155 m) in length at elevation 1657.1 ft (505.1 m). The spillway, in conjunction with the outlet works, will pass a peak discharge of 100,600 ft³/s (2849 m³/s) with 5 ft (1.5 m) of freeboard. The outlet works consist of an approach channel, an intake structure, a 548.5-ft (167-m) long conduit, and a stilling basin. The outlet conduit, with an intake elevation of 1560.3 ft (475.6 m), is 3.75 ft (1.14 m) in diameter, capable of releasing about 486 ft³/s (13.8 m³/s) with the water surface at spillway crest.

Three earthfill dikes were required. Dike no. 1 is located approximately 300 ft (91 m) east of the main embankment. This dike is 935 ft (285 m) in length and 39 ft (11.9 m) in maximum height. Dike no. 2 is located approximately 6000 ft (1829 m) northeast of the main embankment. It is 9005 ft (2745 m) in length and 55 ft (16.9 m) in maximum height. The eastern 3650 ft (1112 m) of this dike, which is designed to divert floodwater from the drainage area northeast of Cave Creek Road, has a variable height ranging from 10 to 6 ft (3 to 1.8 m). Dike no. 3 is located approximately 2.5 mi (4 km) northwest of the main embankment. It is 3245 ft (989 m) in length and 10 ft (3 m) in maximum height.

The detention basin has a capacity of 46,600 acre-ft (5748 ha-m) at the spillway crest, of which 5700 acre-ft (703 ha-m) is for the accumulation of sediment over a 100-year period, and 40,900 acre-ft (5045 ha-m) is for flood control. The detention basin will reduce a standard project flood with a peak inflow of 54,000 ft³/s (1529 m³/s) to an outflow of 486 ft³/s (13.8 m³/s).

3. Adobe Dam. Adobe Dam will be constructed on Skunk Creek across Deer Valley Drive about 1 mi (1.6 km) west of Black Canyon Highway. As now recommended, the embankment will be a zoned compacted earthfill structure of about 63 ft (19 m) maximum height above streambed. The crest of the dam at elevation 1403 ft (428 m), excluding settlement allowance, will be 2.1 mi (3.4 km) in length. An earthfill dike, across the saddle west of the northwest corner of the detention basin, will be required to contain the design flood. The dike will be 1635 ft (498 m) in crest length and about 6 ft (1.8 m) in maximum height. An unlined spillway, 2000 ft (610 m) west of the west (right) abutment of the main embankment, will be about 1325 ft (404 m) in total profile length. The spillway will have a concrete sill 36 ft (11 m) in length, and 1377.8 ft (420 m) in crest elevation. The spillway, in conjunction with the outlet works, will pass a peak discharge of 12,000 ft³/s (340 m³/s) with 5.5 ft (1.7 m) of freeboard.

The outlet works will include an approach channel, an intake structure, a 290 ft (88 m) in length concrete conduit, an energy dissipator, and an outlet channel. The outlet conduit, which will have an intake elevation of 1338 ft (408 m), will be 5.9 ft (1.8 m) in height by 8.9 ft (2.7 m) in width. It will be capable of releasing up to 1890 ft³/s (54 m³/s) with the water surface at spillway crest.

The detention basin will have a capacity of 18,350 acre-ft (2264 ha-m) at the spillway crest, of which 2700 acre-ft (333 ha-m) will be for the accumulation of sediment over a 100-year period, and 15,650 acre-ft (1930 ha-m) will be for flood control. The detention basin will reduce a standard project flood with a peak inflow of 66,000 ft³/s (1869 m³/s) to an outflow of 1890 ft³/s (54 m³/s).

Channelization of Skunk Creek in the vicinity of Black Canyon Highway (previously designated Skunk Creek diversion channel), about 2 mi (3 km) northeast of the east (left) abutment of the dam, will be required to assure conveyance of the standard project flood to the adobe detention basin. Two training levees will intercept and concentrate floodwaters at the bridges. They will be about 5550 and 6590 ft (1692 and 2009 m) in length and 25.5 ft (7.8 m) maximum height near the bridges. The 1 vertical on 3 horizontal sideslope will be revetted where necessary to preclude erosion. A rectangular concrete channel, 629 ft (192 m) in length and 241 ft (73 m) in width, will convey flows under the four existing bridges. A grouted stone section, 271 ft (83 m) in width, will extend 596 ft (182 m) downstream from the bridge section. The channel depth will vary from 18.5 ft (5.6 m) to 14.5 ft (4.4 m) in 1 vertical on 2 horizontal sideslopes. The next 1440 ft (439 m) will have an unlined invert and grouted stone sideslopes. The levees will end at this point, but channel excavation will continue to daylight, where flood flows will reenter the existing water course.

4. New River Dam. New River Dam will be constructed on the New River about 8 mi (12.8 km) upstream from the confluence with Skunk Creek. The main embankment will be a compacted earthfill structure about 91 ft (28 m) maximum height above streambed. The crest of the embankment at elevation 1481.7 ft (452 m), exclusive of settlement allowance, will be 2800 ft (853 m) in length. An earthfill dike, about 7000 ft (2134 m) northwest of the west (right) abutment of the main embankment, will be required along the west edge of the detention basin area to confine the design flood. The dike will be 5800 ft (1786 m) in crest length and about 30 ft (9 m) in maximum height. A concrete lined spillway, 1600 ft (488 m) east of the east (left) abutment of the main embankment, will be rectangular in cross section; it will be 589 ft (180 m) in length, and will vary from 220 ft (67 m) in width at the crest, elevation 1455.3 ft (436.6 m), to 173 ft (53 m) in width at the downstream end of the chute. This rectangular section will include 94 ft (29 m) of approach channel, 470 ft (143 m) of chute structure, and a 25 ft (8 m) long flip-bucket structure. The spillway, in conjunction with the outlet works, will pass a peak discharge of 63,300 ft³/s (1792 m³/s) with 6.5 ft (2 m) of freeboard.

The outlet works will consist of an intake structure, conduit, and an energy dissipator. The 8.5 ft (2.6 m) diameter concrete conduit, with a 1392 ft (424 m) intake elevation, will be 450 ft (137 m) in length and will be capable of releasing up to 2590 ft³/s (73 m³/s) when the water surface is at spillway crest. At the downstream end of the conduit, an energy dissipator will be constructed to reduce the velocity of discharge prior to entering the natural stream.

The detention basin will have a gross capacity of 34,500 acre ft (4256 ha-m), of which 4920 acre ft (607 ha-m) will be for the accumulation of sediment over a 100-year period and 29,580 acre-ft (3649 ha-m) will be for flood control. The detention basin will reduce the standard project flood with a peak inflow to 48,000 ft³/s (1359 m³/s) to an outflow of 2590 ft³/s (73 m³/s).

5. Arizona Canal Diversion Channel. The Arizona Canal diversion channel will be just upstream from the Arizona Canal and will be nearly parallel to it. Where possible, the alignment will be such that the left wall of the channel will be at the north right-of-way line of the canal. The diversion channel will extend from near 40th Street at the upstream end to Skunk Creek, a distance of about 17.3 mi (27.8 km). A paved maintenance road will be provided along the north side of the channel. At the upstream end, extending from about 700 ft (213 m) west of 40th Street to Dreamy Draw near 12th Street, there will be a rectangular concrete channel 4.6 mi (7.4 km) in length, 36 to 50 ft (11 to 15 m) in bottom width, and 21.5 to 25 ft (6.6 to 7.6 m) in depth. From Dreamy Draw to Cave Creek near Black Canyon Highway, there will be a rectangular concrete channel 3.5 mi (5.6 km) in length, 50 to 60 ft (15 to 18 m) in bottom width, and 22.5 to 24.5 ft (6.8 to 7.5 m) in depth; this channel will be covered for 2300 ft (701 m) between Central and Dunlap Avenues. From Cave Creek to about Cactus Road, there will be a trapezoidal concrete-lined channel 4.8 mi (7.7 km) in length, 60 to 245 ft (18 to 75 m) in bottom width, 21 to 23 ft (6 to 7 m) in depth, and with side slopes of 1 vertical on 2 horizontal. From Cactus Road to Skunk Creek, there will be a trapezoidal earth section 4.4 mi (7.1 km) in length, 245 ft (75 m) in bottom width, 19 to 22.5 ft (6 to 6.8 m) in depth, and with side slopes of 1 vertical on 4 horizontal. The design capacity of the diversion channel (for a 100-year frequency flood) will range from 6800 ft³/s (192 m³/s) at Cudia City Wash near 40th Street to 36,000 ft³/s (1019 m³/s) at the Skunk Creek confluence.

The channel will be entrenched for its entire length to allow side inflow to enter over the channel walls. In local areas where ponding will occur, pipe inlets (with automatic drainage gates when required) will be provided. A side channel spillway will be required at Cudia City Wash and at Dreamy Draw, and a confluence structure will be required at Cave Creek. Inlet structures also will be required at other major washes, such as the 10th Street Wash, Myrtle Avenue Wash, and Dreamy Draw Wash. A safety fence will be provided along the channel walls.

At several locations, the Arizona Canal will be relocated to the south so that the diversion channel will miss major developments, such as the Arizona Biltmore Hotel east of 24th Street and the Squaw Peak Filtration Plant west of 24th Street. The canal also was realigned near 59th Avenue to eliminate undesirable curves and to miss an existing subdivision. Four new bridges over the Arizona Canal will be required-- 59th Avenue, Thunderbird Road, and two at the Biltmore Hotel. In all instances where the canal is relocated, the Salt River Project requires that the canal be lined with 3-5/8 in. (9 cm) of concrete on the invert and 1-1/2 in. (4 cm) of gunite on the side slopes.

A total of 26 bridges will be required at the streets and highways that presently cross the canal: one each at 32nd Street, 24th Street, Maryland Avenue, Glendale Avenue, 16th Street, 12th Street, Northern Avenue, 7th Street, Central Avenue, Dunlap Avenue, 7th Avenue, 19th Avenue, Metro Parkway, 35th Avenue, Peoria Avenue, 43rd Avenue, 51st Avenue, Cactus Road, 59th Avenue, and Thunderbird Road; four at Black Canyon Highway (Interstate 17); and two at the Biltmore Hotel.

6. Dreamy Draw. Dreamy Draw downstream from Dreamy Draw Dam to the Arizona Canal has adequate capacity for the 220 ft³/s (6 m³/s) maximum discharge from the dam. Channelization from 14th Street to the Arizona Canal diversion channel was considered for residual flows, but was found to be economically unjustified. To assure the long-term capability to continue to operate Dreamy Draw Dam, as designed, local interests are required, under the local cooperation agreement, to manage and maintain a designated floodway and the floodway fringes, as delineated by the Corps of Engineers, for a 100-year frequency flood. This delineation is presently being prepared and will be added as an appendix to the O & M manual for Dreamy Draw Dam. Dreamy Draw flows will enter the Arizona Canal diversion channel via a spillway over the channel wall.

7. Cave Creek. From Cave Buttes Dam to the Arizona Canal diversion channel, Cave Creek must convey the maximum discharge of about 486 ft³/s (14 m³/s). The existing creek has a capacity greater than the discharge at all cross sections. To assure the long-term capability to operate Cave Buttes Dam as designed, local interests, under the agreement of local cooperation, are required to manage and maintain a designated floodway and the floodway fringes delineated by the Corps of Engineers for a 100-year frequency flood. The delineation of the floodway and floodway fringes for a 100-year frequency flood was included as appendix 2 of the Phase II, Part 1 report. The delineation will be revised based on new topography and will be included in the O & M manual for Cave Buttes Dam.

There is no need to channelize Cave Creek downstream from the outlet channel at Cave Buttes Dam to Peoria Avenue, a distance of about 10 mi (16 km). A channel is required, however, to intercept Cave Creek flows at the Peoria Avenue Bridge (releases from Cave Buttes Dam plus downstream tributary flows) and convey them to the Arizona Canal

diversion channel. The 0.7 mi (1.1 km) long channel is required to hydraulically introduce concentrated flows into the diversion channel. Channelization of this reach will not be required prior to construction of the diversion channel. The existing creek from Peoria Avenue to the Arizona Canal has adequate capacity to convey the maximum dam discharge to the canal. An existing side channel spillway will introduce floodwaters into the canal. Local interests have established the design capacity of the proposed upstream channelization of Cave Creek and the existing Peoria Avenue Bridge at 12,000 ft³/s (340 m³/s). When the freeboard capacity of the proposed bridge was considered, the capacity approached 15,000 ft³/s (425 m³/s). To provide adequate capacity to convey all flows (50-year frequency flood) that could pass under the bridge, the downstream channel will be designed to convey 15,000 ft³/s (425 m³/s) to the diversion channel. Flows in excess of the bridge capacity will enter as sheetflow over the diversion channel walls.

The channel will be a concrete lined trapezoidal section 70 to 80 ft (21 to 24 m) in base width, 9.5 to 24 ft (2.9 to 7 m) in height, with side slopes of 1 vertical on 2 horizontal. A confluence structure will be constructed at the Arizona Canal diversion channel.

The Arizona Canal presently intercepts Cave Creek runoff up to canal capacity, and delivers it to the Salt River Project for use downstream. This runoff includes not only flows from the drainage area below Cave Creek Dam, but also the discharge from Cave Creek Dam. To satisfy Salt River Project's claim to this water, a water conservation diversion channel will be constructed at non-Federal cost to divert up to 500 ft³/s (14.2 m³/s) from Cave Creek near Peoria Avenue, convey it across the Arizona Canal diversion channel, and discharge it into the canal. An alternative to this water delivery will be a possible diversion into the Water and Power Resources Service (formerly the Bureau of Reclamation) proposed Granite Reef aqueduct. Such a diversion will be preferable, inasmuch as it will deliver waters to the headgate of the Salt River Project rather than along the lower reaches of the Arizona Canal. More detailed studies are required by the Water and Power Resources Services before implementation of such a proposal; in addition, implementation of such a proposal will have to await completion and operation of the Granite Reef aqueduct. This alternative will be analyzed in detail in the Phase II Design Memorandum, Part 5, Arizona Canal Diversion Channel.

New bridges are required at five crossings. Although the bridges will be designed by local interests for total flows entering Cave Creek below Cave Buttes Dam, a design discharge of only 500 ft³/s (14.2 m³/s) is required to permit operation of Cave Buttes Dam; therefore, project cost estimates are limited to the cost of providing 500 ft³/s (14.2 m³/s) bridges. These bridges are at Pinnacle Peak Road, Deer Valley Drive, 7th Street, Beardsley Road, and Union Hills Drive.

8. Skunk Creek. That part of Skunk Creek discussed in this section extends from the proposed Adobe Dam to the New River. From the dam to the Arizona Canal diversion channel, a distance of about 5.6 mi (9 km), the existing creek has a nondamaging capacity greater than the $1890 \text{ ft}^3/\text{s}$ ($53 \text{ m}^3/\text{s}$) discharge from Adobe Dam. To assure the long-term capability to operate Adobe Dam as designed, local interests will be required to manage and maintain the designated floodway and floodway fringes to be delineated by the Corps of Engineers.

From the Arizona Canal diversion channel to the New River, a distance of about 1.8 mi (2.9 km), flowage easements will be acquired to assure positive control of the flood plain resulting from flows discharging from the diversion channel. The flowage easements will range from about 2500 to 3000 ft (762 to 914 m) in width and encompass about 510 acres (206 ha). Within this reach of Skunk Creek, concrete floodwalls up to 4 ft (1.2 m) in height will be constructed around two residences; five residences will be removed and three mobile home pads will be raised about 3 ft (1 m) each. New bridges are required at Beardsley Road and 67th Avenue.

9. New and Agua Fria Rivers. The river reaches discussed in this section extend along the New River from the proposed New River Dam to the Agua Fria River, a distance of about 16.1 mi (25.9 km) and along the Agua Fria River from the New River confluence to the Gila River, a distance of about 10.1 mi (16.2 km). The New River, between the proposed dam and Skunk Creek, a distance of about 8.5 mi (13.7 km), has a nondamaging capacity greater than the $2590 \text{ ft}^3/\text{s}$ ($73 \text{ m}^3/\text{s}$) discharge from New River Dam. To assure the long-term capability to operate New River Dam as designed, local interests will be required to manage and maintain the designated floodway and floodway fringes to be delineated by the Corps of Engineers.

Downstream from the mouth of Skunk Creek, flowage easements will be required along the New and Agua Fria Rivers, about 17.7 mi (28.5 km), to assure positive control of the flood plain under the condition of diverted flows discharging from the diversion channel. The flowage easement (including rights-of-way) will be about 300 to 4000 ft (91 to 1219 m) in width along the New River, about 900 to 6000 ft (274 to 1829 m) in width along the Agua Fria River, and will encompass about 2110 and 5950 acres (854 and 2408 ha), respectively.

Within these reaches of the New and Agua Fria Rivers, floodproofing, permanent evacuation of the flood plain, bank stabilization, levee construction, and some channelization and channel clearing are proposed. Concrete floodways up to 4 ft (1.2 m) in height will be constructed around 14 residences; earth levees up to 8 ft (2.4 m) in height will be constructed around four housing developments and around a sewage disposal plant near Lower Buckeye Road; two mobile home pads will be raised about 3 ft (1 m) each; and eight residences will be removed. Three of these levees must be designed for standard project flood flows

because of the possible catastrophic consequences if designed for a lesser discharge.

In Peoria, U.S. Highway 60-89-93 (Grand Avenue), a divided highway, and the Atchison, Topeka and Santa Fe Railroad bridges cross the New River. The railroad crossing consists of a timber trestle, 130 ft (40 m) in length and a four-span bridge, 243 ft (74 m) in length. Each of the two existing highway bridges are six-span bridges with a total length of about 360 ft (110 m). The trestle portion of the railroad bridge has apparently caused an aggragation of material along the east (left) bank of the river immediately upstream of the trestle making the two eastern spans of the highway bridge ineffective. To allow free flow of a 100-year flood through the bridges, the timber trestles will be replaced by a two-span bridge and about 3000 ft (914 m) of the river will be realigned and deepened. Channelization will extend from a point about 1800 ft (549 m) upstream of the highway bridges to about 1200 ft (366 m) downstream of the highway bridges. The unlined channel will be 300 ft (91 m) in width, 12 to 15 ft (3.6 to 4.7 m) in depth with 1 vertical on 2 horizontal revetted side slopes. A 5700 ft (1737 m) long revetted levee up to 4 ft (1.2 m) in height will extend upstream of the channelization to Thunderbird Road along the east (left) bank of the river. Construction of this levee will reduce the overflow area and flowage easement requirements by about 200 acres (81 ha). Downstream of the channelization, about 7000 linear ft (2134 m) of revetment will be placed along the west (right) river bank to preclude bank erosion and possible damage to development along the river's edge.

In addition to the extension of the Atchison, Topeka and Santa Fe Railway bridge, new bridges are required at seven crossings along the New River: Beardsley Road, Union Hills Drive, 83rd Avenue, Thunderbird Road, 99th Avenue, Northern Avenue, and Camelback Road. New bridges are required at four crossings over the Agua Fria River: Thomas Road, McDowell Road, Van Buren Street, and Lower Buckeye Road. Inasmuch as no formal channelization is proposed along these reaches, the existing type of river crossings are considered adequate for normal runoff conditions. However, because the dams will detain floodwaters and release them over a period of many days, making the existing dip crossings impassable over an extended period of time, bridges were included as a project cost. Although the bridges probably will be designed by local interests to reflect the total flows at the bridge crossings, project cost estimates reflect bridges designed to allow the passage of only the releases from the upstream dams.

C. RESERVOIR OPERATION. The four dams included in the New River and Phoenix City Stream project are designed to hold water only during times of floods. Regulation of flood water will be automatic through the ungated outlet conduits.

In the event of a standard project flood or a maximum probable flood, containment of floodwaters is a factor contributing to a period of non-resource use within the basins, as shown in table 1.

Table 1. Cause and Duration of Non-Resource Use of Basins.

Dam Basin	Flood		Acre- Feet	Cubic Hecto- metre	Drawdown Time (days)
	Standard Project	Maximum Probable			
Dreamy Draw	x	x	320	0.4	0.81
			770	0.9	1.21
Cave Buttes	x	x	42,200	52.1	48.00
			122,000	150.5	50.54
Adobe	x	x	17,000	21	9.54
			61,000	75.2	14.63
New River	x	x	39,000	48.1	7.71
			105,000	129.5	9.71

Design and Construction Status

Chapter 3

DESIGN AND CONSTRUCTION STATUS

Construction of the flood control works and recreation facilities will be done under several contracts. Construction of the recreation facilities is dependent on funding capabilities of the local sponsor.

The project will be constructed in phases, as described below. As flood control-related construction proceeds, the flow regimen will be altered, but full protection will not be achieved until all elements are completed. Under present conditions, flows are high magnitude with short duration (generally less than one day). The dams will change this flow regimen to much lower flows with a correspondingly longer duration.

The first and second features are Dreamy Draw Dam (completed in 1973) and Cave Buttes Dam (completed in 1979). The third and fourth construction features, respectively, are Adobe Dam (and the Skunk Creek channel at Black Canyon Highway) and New River Dam. This order of construction is preferred by local interests and will allow more time to complete cultural resources studies at the New River Dam site.

During the period of technical design and construction for Adobe and New River Dams, technical design will be initiated and completed on Skunk Creek below the Arizona Canal diversion channel and on the New and Agua Fria Rivers. In that report (DM No. 3, Phase II, Part 4), the required flowage easements will be delineated and the recommended structural measures will be designed. Completion of the construction of Adobe and New River Dams, and acquisition of the flowage easements and completion of construction along the New and Agua Fria Rivers, are considered necessary prior to the construction of the Arizona Canal diversion channel.

The diversion channel will be the last flood control feature constructed. Although the Phase II, Part 5 report will cover the entire reach (40th Street to Skunk Creek), the diversion channel will be divided into four smaller reaches, each constructed under a separate contract. They are, in the order of construction: (a) Skunk Creek to Cactus Road, (b) Cactus Road to Cave Creek, (c) Cave Creek to Dreamy Draw, and (d) Dreamy Draw to 40th Street. The Phase II, Part 5 studies were initiated in FY 78 to determine rights-of-way requirements as early as possible to allow local interests to begin acquiring land in advance of further urbanization.

Recreation development also will be phased. Factors determining development sequence and scheduling include the following: preparation of engineering design information relating to flood control features; development of surrounding land uses; desires of local recreation sponsors; and funding capability of local recreation sponsors. In some

cases, recreation construction will begin prior to completion of flood control construction; in other cases, it will not commence until some time after completion of flood control construction.

The anticipated phased recreation construction start and completion dates are listed in Table 2.

Table 2. Recreation Construction Schedule.

Feature	Start Date (FY)	Completion Date (FY)
Dreamy Draw Dam	81	82
Cave Buttes Dam--Phase I	82	83
Cave Buttes Dam--Phase II	84	90
Cave Creek Regional Park--Phase I (Federal)	85	85
Cave Creek Regional Park--Phase I (Non-Federal)	85	85
Cave Creek Regional Park--Phase II (Non-Federal)	89	90
Adobe Dam-Phase I	82	83
Adobe Dam-Phase II	84	85
New River Dam	?	?
Arizona Canal diversion channel (Skunk Creek to Cactus Road)	87	88
Arizona Canal diversion channel (Cactus Road to 40th Street)	88	91
Skunk Creek, New and Agua Fria Rivers flowage easements	86	86

Environmental Resources

Chapter 4

ENVIRONMENTAL RESOURCES

A. GENERAL. The following section presents the environmental resources considered as a whole in the development of the land use plan for the New River and Phoenix City Streams project. The intrinsic qualities of the environmental resources for the projects will be identified in this section leading to the development of appropriate resource uses.

B. CLIMATOLOGY. The project area is located in the Sonoran Desert Climatic Zone. The climate of the project area, like that of the City of Phoenix, is dry, receiving an average of less than 8 in. (203.2 mm) of precipitation a year. Summer thunderstorms of high intensity, but short duration, bring most of the annual rainfall. The summers are hot and the winters are mild, with clear days and cool nights. U.S. Weather Bureau records indicate a long-term average temperature of about 70° F (21.1° C), with the temperature ranging from a summer maximum commonly above 100° F (38° C) to a winter minimum seldom below 32° F (00° C). The prevailing winds are from the east during the day and from the west at night. Average wind velocities are low to moderate, approximately 6 mph (10 km/h) except for high gusty winds that may accompany July and August thunderstorms. A graphic summary of the climate is provided on plate 3.

The project area has an average relative humidity ranging from 24 percent in the summer to 54 percent in the winter. Relative humidity has increased in the Phoenix area as the result of large irrigated areas, open canal systems, and urban plantings. The combination of high temperatures, low relative humidities, a maximum amount of sunshine, and wind causes a high evaporation rate estimated at 6.5 ft (2 m) per year.

C. PHYSIOGRAPHY. All of the flood control features are located in the Sonoran Desert region of the basin and range physiographic province. The project area is within the Gila River Basin; this is the largest drainage area tributary to the lower Colorado River, comprising 58,200 mi² (150,738 km²). About 70 percent of the drainage area is mountainous, while the remainder is alluvial valley. The Phoenix metropolitan area, situated in the Salt River Valley, is effectively surrounded by the Phoenix Mountains to the north, the McDowell Mountains to the northeast, the Usony Mountains to the east, the South Mountains to the south, and the Sierra Estrella to the southwest. Only to the west and southeast do the rolling desert plains typical of the metropolitan area continue uninterrupted. The mountains are characterized by rugged terrain and steep gradients, while the valleys are fairly flat with regular slopes. Elevations range from 910 ft (277 m) at the confluence of the Agua Fria and Gila Rivers to 7000 ft (2134 m) in the mountains near the headwaters of the Agua Fria River.

D. GEOLOGY. The project area is located in the Sonoran Desert Section of the basin and range physiographic province. This province is characterized by steep mountains and broad alluvium-filled valleys. The mountain ranges, which are generally parallel and trend northwest to southeast, are composed of metamorphic and volcanic rock. The basins are filled with alluvial and colluvial materials--primarily gravel, sands and clays--to depths of over 1000 ft (305 m). The valley floor was formed by extensive alluvium deposits, which have filled the basin and covered the foreslopes of the hills and mountains. Alluvium in the valley may extend to depths of over 1000 ft (305 m) and consists of coarse, unconsolidated, unsorted sands, gravels and cobbles. The deep dissection of the mountains and the extent of the alluvial fans suggest that the project area has had a long history of erosion and deposition.

E. SEISMICITY. The earthquake potential in the project area is considered small. On the Seismic Risk Map of the United States, the area is arranged to zone 2, which is a low seismic risk zone. Severe earthquakes in California and Mexico have been widely felt throughout southern Arizona, but only a few weak earthquakes have had epicenters in southern Arizona during the recorded earthquake history.

F. HYDROLOGY. The watercourses of the Agua Fria River, New River, Gila River, and Skunk Creek are generally characterized by well defined floodways and channels. The channels of Cave Creek and Dreamy Draw are well defined above the Arizona Canal; downstream from the Canal, the natural floodways have been obliterated by urban development. Flows in the channels are ephemeral because climate and drainage characteristics are not conducive to continuous runoff. Flows occur only during and immediately after periods of heavy rainfall.

Surface flows percolate through the ground and may enter the ground water supply. Current urbanization is causing an appreciable increase in the amount of impervious area, especially in the lower reaches of the drainage area. Thus a lesser amount of flow is percolated, and the amount of runoff flow is increased. In addition, increased urbanization, through the increases in the impervious area and paving of streets, has resulted in increased velocities of flows with a resultant increase in peak discharges. The increase in runoff flow and peak discharge are causes of increased flooding.

G. GROUND WATER. The ground water basin is generally bounded on the north and east by the McDowell Mountains; on the south by the South Mountains; on the southwest by the Sierra Estrella Mountains and Buckeye Hills; on the west, by the White Tank Mountains. Aquifer depth to bedrock exceeds 1000 ft (305 m) over much of the ground water basin (Thiele, 1965). Ground water occurs in discontinuous layers and lenses in the sands and gravels of the basin alluvium. Within the project area, the depth to ground water can vary tremendously--from only a few feet along the Salt River to several hundred feet along Cave Creek.

H. SOILS. The soil types in the study area are derived from parent materials characteristic of the basin and range physiographic province. The soils in the gently sloping valleys are deep, heterogeneous in texture, low in organic material, and have not been leached of soil nutrients. The relatively level surface, combined with soils of favorable workability, provide areas of good cropland where irrigation is available. General soil types in the project area are sandy loams, limy clay loams, and limy loamy soils (U.S. Department of Agriculture, 1969). Stony and rocky soils are locally present on slopes greater than 30 percent. The soils in the study area are commonly affected by the precipitation of salts produced by weathering of rock-forming minerals and brought in by surface runoff. Because seepage from rainfall is usually not sufficient to carry salts down to the water table, they accumulate in the soil as the water evaporates. The effects are most noticeable near mountains formed of calcium-bearing rocks, where alluvial deposits are commonly cemented by calcium carbonate to a concrete-like material called caliche. Farther down the basin slopes, calcium carbonate content decreases, but soluble alkali salts detrimental to agriculture are still present. Erosion from the drainage above the proposed dams was calculated by the Corps of Engineers for the purpose of determining sediment storage requirements in the reservoirs. The sediment yield of 0.3 acre-ft/mi² (.0143 ha-m/km²) was estimated for the drainage area upstream of the dams.

Site specific soils may vary with each flood control feature. These will be identified in the individual feature master plans.

I. VEGETATION. The project area and adjacent lands are typically Arizona desert, which is part of the Sonoran Desert Region. Geographically, the project areas are typified by broad desert valleys and desert mountains. The vegetation types include perennial and ephemeral desert shrub, with scattered riparian communities along the drainageways. The riparian plants are mesquite, sycamore, arrow weed, and salt grass. Perennial shrubs are characterized by such cacti as saguaro, cholla, and prickly pear. Also occurring are the palo verde, ocotillo, catclaw, desert broom, and several kinds of forbs. The ephemeral class is distinguished by creosote bush, bursage, annual forbs, and grasses.

Environmental disturbances have occurred in the various desert wash habitats and, to a lesser degree, in the desert outwashes and upland habitats. Gravel mining, roads, farming, grazing, and trails account for most of the loss or heavy disturbance of desert wash and outwash vegetation. Construction of the project features also will lower the quantity and quality of habitat areas. However, acquisition of offsite lands and revegetation of borrow areas and embankments will help to mitigate the impact of habitat losses.

J. RARE AND ENDANGERED VEGETATION. The State of Arizona has statutes protecting various native plants growing wild on State, or publicly and privately owned lands. The statutes are administered by the Arizona Commission of Agriculture and Horticulture. Among the protected plants are all species of the lily, amaryllis, orchid, orpine, and cactus family. It is unlawful to take or transport protected plants from their original growing site without a valid permit from the Commission of Agriculture and Horticulture. The Endangered Species Act of 1973 provided for the establishment of a Federal endangered plants lists. A report on Endangered and Threatened Plant Species of the United States was published by the U.S. Government Printing Office, 1975.

K. WILDLIFE. Wildlife is present in all the various habitats (natural desert communities, agricultural, and urban) within the study area. The largest number and greatest diversity of desert fauna within the Phoenix project area appear to occupy the desert wash and upland habitats north of Phoenix. This is related to the abundance of wildlife plant foods in these habitats. Areas of intensive urban development and agricultural activity usually have a limited wildlife diversity and abundance, although some bird species flourish around agricultural areas. Wildlife found in various habitats throughout the Phoenix study area includes: amphibians and reptiles, such as toads, frogs, lizards, and snakes; many bird species, as indicated by a listing of 346 species in the annotated field lists of Birds of Maricopa County (Demaree, Radke, and Witzeman, 1972); and mammals, such as bats, rodents, skunks, rabbits, coyotes, and deer.

Although desert wildlife species are adapted to very dry conditions, most species depend on some free water. Consequently, animals are most abundant where water or succulent foods are available. The streambeds and riverbeds attract and concentrate animal populations at various times, depending on the availability of food, water, and cover. Periods of rainfall usually occur in the Phoenix area during both summer and winter, providing at least temporary sources of water. Some gravel pits along the drainages in the study area contain ponded water throughout most of the year. Effluent from sewage treatment plants and sedimentation ponds, such as along New and Agua Fria Rivers, also provides water sources for wildlife in the Phoenix area.

Wildlife, particularly birds, is concentrated by the vegetation in desert washes and along major creeks and rivers. This vegetation, especially mesquite, provides important nesting, feeding, resting, and roosting sites. As agricultural, mining and urban uses have eliminated much of the natural habitat along the major drainageways in the area, the remaining riparian habitat is particularly important to wildlife as a refuge area providing adequate food and cover sources.

Although some reaches of the Agua Fria and New Rivers and Cave and Skunk Creeks remain relatively natural, the biological communities along most of the channels have been considerably altered as a result of sand

and gravel mining, off-road vehicular use, and unauthorized trash disposal. The desert upland areas, part of the proposed Adobe Dam and Cave Creek Dam sites, and most of the New River area, contain relatively undisturbed natural vegetation, although these areas have experienced some habitat degradation and loss caused by sand and gravel mining, off-road vehicular use, camping, vandalism, and trash disposal.

As part of the flood control provisions, approximately 410 acres (166 ha) of wildlife habitat have been acquired by the Flood Control District of Maricopa County. The mitigation site is located along the Gila River southwest of Buckeye, Arizona, and is managed by the Arizona Game and Fish Department.

L. ENDANGERED WILDLIFE. The peregrine falcon, which is presently on the endangered species list established by the Endangered Species Act of 1973, may be an occasional migratory visitor to the project area. Two peregrine falcons were observed during the 1971 Christmas bird count. It is unlikely that the peregrine falcon nests in the study area because suitable nesting habitat is lacking. No other endangered wildlife species are known to utilize the project area.

M. PALEONTOLOGY. No significant paleontological investigations have been conducted within the project area because there is no evidence of fossils within the project area.

N. ARCHEOLOGY. Research into the archeologic and historic resources in the project area was carried out by Arizona State University, Department of Anthropology, under contracts with the National Park Service and the Corps of Engineers. Material presented in this section was obtained from two reports prepared under these contracts: An Archeological Survey in the Gila River Basin, New River and Phoenix City Streams, Arizona Project Area, and An Archeological Survey of the Cave Buttes Dam Alternative Site and Reservoir, Arizona (Arizona State University, 1974).

Significant archeologic sites were discovered in the Cave Buttes, New River, and Adobe Dam project areas. The archeologic sites range from small special activity sites, such as lithic scatters with diameters of only a few yards, to large village sites with artifacts distributed over an area of about 0.45 mi² (1.16 km²). The Adobe Dam site contains a significant petroglyph site. Three sites have been determined by the Secretary of the Interior to be eligible for inclusion in the National Register of Historic Places; they are now known as the New River, Skunk Creek, and Cave Buttes Archeological Districts. Significant archeologic remains were not found in the Dreamy Draw project area.

Construction of the three dams will result in alteration or destruction of all or part of the three archeologic districts that have been nominated for inclusion in the National Register of Historic

Places: Cave Creek, Skunk Creek, and New River Archeological Districts (pl. 4). Proposed mitigation studies will lessen the direct and indirect impact, but will not completely eliminate the losses.

O. HISTORY. Evidence of recent historic activities (1800-1900) in the project areas is abundant as large tracts of land show the effects of the cultivation. Occasional remains of structures have been encountered and are recorded in the field journals, but without site designations.

Within the reservoir area of the Cave Buttes Dam, there exists a concrete multiple-arch dam; for clarity, this will be designated "original Cave Creek Dam." In October 1976, the Arizona State Historic Preservation Officer prepared a draft nomination to include the original Cave Creek Dam in the Cave Creek Archeological District. In February 1977, the Corps requested an opinion from the Secretary of the Interior with respect to the dam's eligibility for inclusion in the National Register; a letter from the Officer of Archeology and Historic Preservation, dated 22 March 1977, attested to the dam's eligibility.

As described in the EIS filed with the Council on Environmental Quality, the original dam would have been removed. But now, consistent with Federal policy to preserve such structures of national significance, the dam will remain in place. A bypass channel has been constructed to pass major floodflows around the original dam, thereby allowing it to be safely preserved within the reservoir area.

The concept of adding a bypass channel to preserve the original dam was coordinated with the Arizona State Historic Preservation Officer and the staff of the Advisory Council on Historic Preservation. It was determined that construction of the bypass channel and unavoidable periodic inundation of the original dam would not adversely affect it. An environmental assesement addressing the effect of the bypass channel and preserved dam has been prepared. This assessment documents the District Engineer's determination that a Supplemental EIS will not be prepared. An Amplification to the Final EIS, New River and Phoenix City Streams, Flood Control Project, Maricopa County, Arizona was prepared by the Los Angeles District in Deceember 1977 and filed with the Council on Environmental Quality.

P. MINING CLAIMS. There are no known resources of coal, crude oil, or metallic and nonmetallic minerals in the project areas. Sand and gravel, a resource that is becoming more limited in the region because of vast quantities of aggregate materials used by the construction industry, occurs in recoverable concentrations in exposed and buried stream channels, on terraces near mountain fronts, and on alluvial fans. In the past, sand and gravel have been removed from the Dreamy Draw Dam, Adobe Dam, and Cave Buttes Dam areas.

The reserved mineral rights within the basin are under the jurisdiction of the Bureau of Land Management. The Corps has pending an application to withdraw these rights from the public domain.

Q. LAND USE. Outside of the Phoenix Mountains Preserve, the location of Dreamy Draw Dam, land use is primarily high density residential development interspersed with commercial development. Southeast and northwest of the Adobe Dam site, high density residential development occurs. The proposed alignment of the Arizona Canal diversion channel passes directly through a highly urbanized section of the city. Cave Buttes Dam and the proposed New River Dam site are presently surrounded by open space, as the proposed Adobe Dam site once was. If the urbanized area around Phoenix expands, as it has over the past 20 years, all the dam sites will eventually become pockets of open space within a continuous urban complex similar to the Dreamy Draw Dam site within the Phoenix Mountains Preserve. The projected pattern of regional growth by the year 2000 was studied by the Maricopa Association of Governments in 1978 (pl. 5).

R. VISUAL QUALITY. The degree of esthetic appreciation and enjoyment of an area is influenced by the visual quality of that area. Visual quality is defined as the composite of elements or scenic resources of an area that convey the character of the area to the individual.

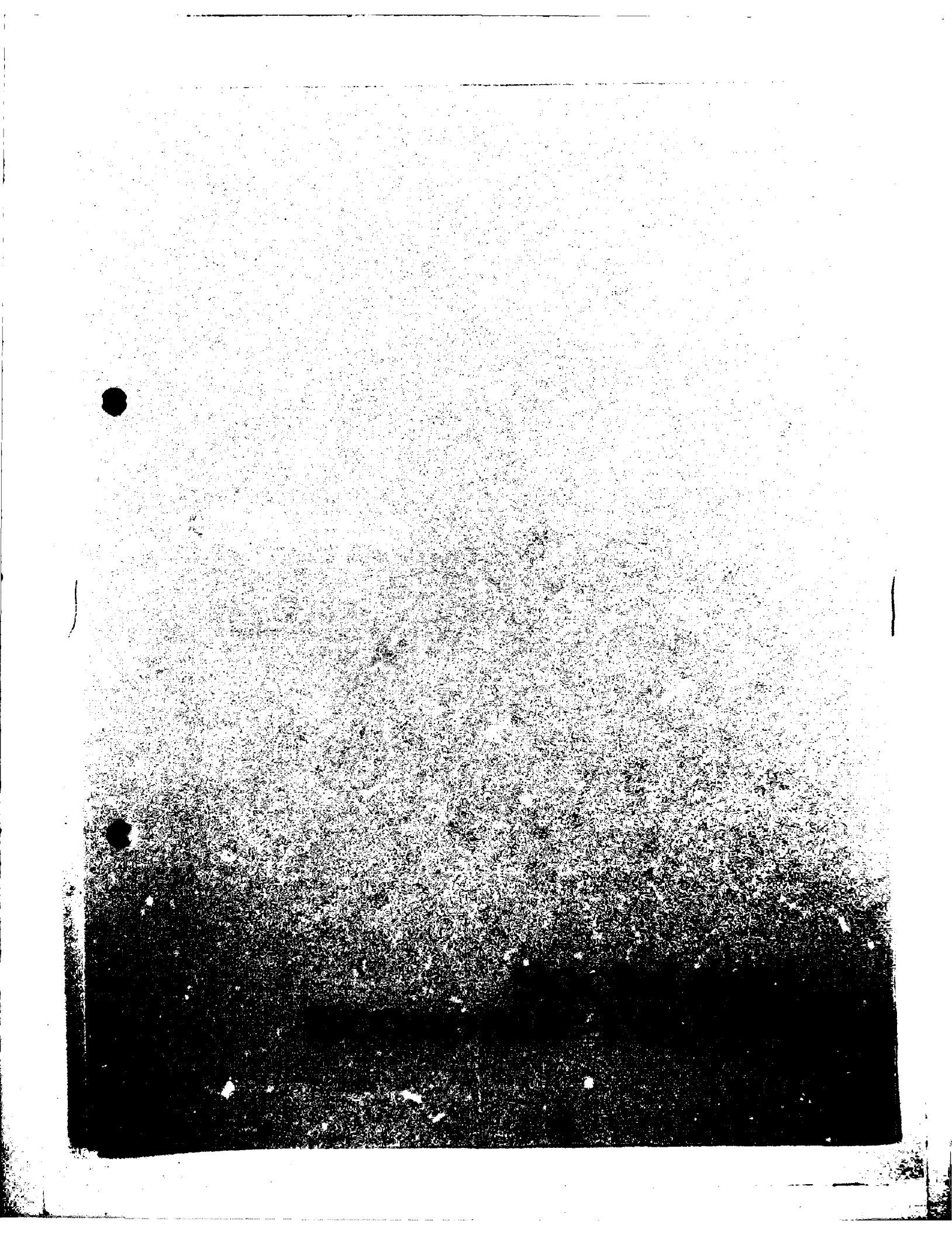
Phoenix lies on a flat, gently-sloping piedmont, broken only by distinct, rugged mountains. The subtle, muted desert colors are enhanced in the sharp light of early morning and late afternoon. In the spring, following the winter rains, annual flowering plants carpet the desert, and the perennial vegetation greens and blooms. Until recently, the clear visibility for 50 mi (80 km) or more enhanced the sense of space; but now, degradation of air quality in the area often reduces the visibility to 8 to 12 mi (13 to 19 km) or less. Despite smoke, dust, and other air pollutants, Arizona's sky is still spectacular, especially in the summer when cumulus clouds build up in the afternoon.

The visual quality of the project area has been shaped by natural and man-made forces modifying the landscape. Topographic variations within the project area yield a variety of visual experiences. The relatively gently sloping flood plain of the project area channels contrasts with the steep mountainous regions flanking the basins.

Vegetation within the basins is characteristically sparse and scattered, with the exception of clusters of dense growth along the stream channels. The New River site offers heavy vegetal cover and has experienced relatively few past destructive uses.

Several areas in and around the other basins have been scarred by human activity, such as construction of flood control features, clearing of roads used during construction activities, and past agricultural uses. Off-highway vehicles and mining activities also have altered the

visual esthetics of the feature areas. The impairment of visual quality associated with construction of the flood control features and excavation of the borrow areas will be somewhat offset by revegetating the borrow areas and landscaping the embankments and the Arizona Canal diversion channel.



Chapter 5

SOCIAL AND ECONOMIC FACTORS

A. GENERAL. This section presents an overall view of the social and economic factors considered in the formulation of the master plans and FDMS. These include: area of influence, demo-graphic considerations, accessibility of the recreation resources, anticipated attendance and visitation, and a sociological perspective that is a profile of user needs and preferences.

B. AREA OF INFLUENCE. The area of influence, or recreation market area, defines the geographic region from which visitors will travel to participate in recreation experiences. The recreation market area (pl. 6) is delineated by five concentric circles radiating from a point central to the four damsites. This breakdown exhibits the primary influence associated with the New River and Phoenix City Streams Project. The estimated population distribution for 1980 within the five concentric circles is tabulated below.

Distance from the Project Centroid mi (km)		Approximate Zone Population
0-10	(0-16,	36,000
10-20	(16-32)	1,106,000
20-30	(32-48)	244,000
30-40	(48-64)	40,000
40-50	(64-80)	14,000

Ninety-six percent of the total market area population (approximately 1,386,000 of 1,440,000 persons) live within Maricopa County. This 96 percent of the market area population accounts for the majority of the county's 1979 population of 1,453,500 persons. Therefore, for ease of statistical collection, Maricopa County will be considered the primary market area.

Use from outside of Maricopa County by residents of Pima, Yavapai, Coconino, Navajo, and Apache Counties does have a measurable impact on many of the outdoor recreation activity categories within Maricopa County. Nonresidents of the State make a fairly heavy utilization of this county's recreation resources, as well.

However, according to the 1978 Arizona Statewide Comprehensive Outdoor Recreation Plan (SCORP), 80 to 100 percent of all outdoor recreation activities occurring in Maricopa County can be attributed to residents of the county.

C. ALTERNATIVE RECREATION RESOURCES. The City of Phoenix has preserved two major mountain areas, each over 7000 acres (2833 ha), as parks. These desert mountain parks are largely undevelopable due to the terrain, but do contribute to a feeling of open space within the city. Two district parks each under 1000 acres (405 ha), have been developed, and an additional one has been proposed. Other parks are smaller and occur randomly throughout the city. The parks are urban oriented, with the exception of undevelopable portions of the mountain parks.

Maricopa County Parks and Recreation Department has been responsible for much of the acquisition and development of park lands within the market area (pl. 7). These parks are regional in appeal and all occur within 1-hour travel time from central Phoenix. The Sun Circle Trail, a system of hiking and riding trails, forms a 110 mi (177 km) loop around the Phoenix metropolitan area forming connecting links with the city and county park trail systems (pl. 8).

The proposed development along Reach 11 of the Central Arizona Project, from Cave Creek Road to Tolleson, would include a wide variety of recreation facilities.

Other cities within the market area have smaller parks--generally neighborhood or community type in appeal. The following is a quotation from the 1978 Arizona Outdoor Recreation Coordinating Commission (AORCC) SCORP report: "Outdoor Recreation in Maricopa County is predominantly urban oriented as expected from the large metropolitan center present. *** As the cost of travel goes up with increasing fuel costs there may be more need perceived by the public for these types of facilities nearer to the urban metropolitan area. As handicapped and urban minorities become more active in outdoor recreation there may be additional pressure to develop more of the urban alternatives."

Table 3 shows the regional parks in Maricopa County and their acreages.

Table 3. Inventory of Regional Parks in Maricopa County.

Jurisdiction/Name	Acres		
	Total	Developed	Potentially Developable
Phoenix:			
Camelback Mountain Park	474.79	10.00	0
Phoenix Mountains Preserve	7,700.00	25.00	200.00
Papago Park	888.64	820.61	0
South Mountain Park	15,700.07	800.00	0
Cave Creek Park & Scenic Drive	481.10	0	481.10
Encanto Park	61.01	61.01	0
Esteban Park	64.08	64.08	0
Alvord Park	346.00	0	346.00
Maricopa County:			
Black Canyon Shooting Range	1,433.70	1,000.00	200.00
Buckeye Hills	4,473.90	200.00	2,000.00
Casey Abbot Park	2,124.06	600.00	1,500.00
Cave Creek	3,002.50	0	1,500.00
Thunderbird	726.68	50.00	300.00
Usery Mountain	3,324.24	300.00	3,000.00
Estrella Mountain	16,467.91	0	8,000.00
Lake Pleasant	14,396.00	400.00	4,000.00
McDowell Mountain	20,941.73	140.00	14,000.00
White Tank Mountain	26,331.00	700.00	12,000.00
Paradise Valley Park	340.00	160.00	180.00
Spook Hill Recreation Area	267.40	5.00	262.40
Scottsdale:			
McCormick Railroad Park	30.00	30.00	0
Chapparal Park	74.00	74.00	0
Indian School Park	60.00	60.00	0
Eldorado Park	55.00	55.00	0
Vista Del Camino	40.00	40.00	0
McDowell Mountain Park	1,280.00	0	200.00
Tempe:			
Papago Park	450.00	56.00	0
Kiwanis Park	125.00	90.00	35.00
Wickenburg:			
Constellation Park	288.00	30.00	258.00

D. **DEMOGRAPHIC CHARACTERISTICS.** Population statistics are taken from Maricopa County, which comprises 95 percent of the project area. The Arizona Statistical Review for 1978, reports the population in the county was 1,346,500. Arizona is the sixth largest state in area in the nation and was the first in population growth (51.4 percent) from July 1968 to July 1978. Approximate 1978 Maricopa County figures show a 38 percent increase in population from the 1970 census. A continuation of this growth rate, which is forecast, projects a population of 1,621,900 by 1985, and 2,353,300 by 2000.

Maricopa County's 1978 population is classified as approximately 94 percent urban, with an average density of 145.9 persons mi². The highest density is centered in the Phoenix metropolitan area.

The Maricopa County population breakdown, according to the Republic Gazette survey, is as follows:

<u>Years</u>	<u>Percentage</u>
17 and younger	34.0
18 to 64	55.3
64 and older	10.7
27.8	median

1. **Education.** The 1978 Maricopa County survey provides this information: Persons 25 years and older have 12.8 years of schooling; 35 percent are high school graduates; approximately 20 percent have college degrees. In 1977, 89,619 people were enrolled in institutions of higher learning--an increase of over 20 percent since 1973. Forecasts project this trend for higher education will continue.

2. **Income.** According to the Republic Gazette survey, Inside Phoenix, the 1978 median income level, per household, was \$14,011, which was a 6.9 percent increase from the 1977 level. The 1977 per capita personal income level was \$6,747, which was a gain of \$477 over the previous year. The predicted 1980 figures indicate a 22 percent increase in per capita income.

Variation in income levels within the project area are great. Northeastern Phoenix, which is the Paradise Valley region, had a median income level, per household, of \$15,000 and over; central Phoenix, along the highway corridor, and south Phoenix show a median income level per household of less than \$10,000.

3. **Employment.** As of June 1978, the Arizona Statistical Review reports 563,800 persons were employed in Maricopa County during the previous year. Employment trends show an increase of jobs, especially in the services, manufacturing, construction, and wholesale-retail trade industries.

The following is the June 1978 occupation breakdown for Maricopa County from the Arizona Statistical Review:

Non-farm wage & salary	
Manufacturing	88,500
Mining	600
Construction	38,600
Transportation & public utilities	27,000
Wholesale & retail trade	132,800
Finance, real estate	36,100
Services	95,900
Government	91,400
Total - Non-farm wage & salary	510,900
Adjustment & all other jobs	52,900
Total employed	563,800
Unemployed	
Number	33,500
Rate (seasonally adjusted)	5.3%

The Arizona Department of Economic Security projects agriculture and mining employment opportunities will decrease in the following years. This decline is directly attributable to the rapid urban growth of the county.

4. Economy. Today, the economy of Maricopa County is based on manufacturing, tourism, retirement, and agriculture. The principle factors responsible for urban growth have been the natural increases in population, corresponding migration to the southwest, and the growth of the defense and aerospace industries.

In 1978, Maricopa County was the largest producer of crops and livestock in the State and the fifth largest in the nation. In 1977, Maricopa County had 509,900 acres (206,354 ha) of crops. The largest crop was cotton; also included were alfalfa, citrus, grains, and vegetables.

Ranked as the second leading income producer in 1977 was the tourism and travel industry; it played a major role in the economy of the county. The tourism industry generated over a billion dollars of revenue in 1976, and it had a 10 percent increase in 1977. This same pattern continued for 1978. Statistics show over nine million passenger cars entered Arizona in 1977. The natural and cultural attractions, coupled with warm dry climate, make Maricopa County a prime destination spot for year-round travelers and conventioners from all over the world.

Two-thirds of Arizona's manufacturing firms and three-fourths of the manufacturing employment are located in Maricopa County. The largest manufacturing class is electrical and electronic equipment and supplies. The group is aided by defense contracts for the research and

development of electronic products. The growth in these industries is also attributable to the following conditions:

- Low humidity levels in Arizona are conducive to the manufacture of electronic equipment.
- Specific locational requirements do not exist for such industries as electronics.
- Local planners look favorably on the desirability of attracting and retaining "clean" (nonpolluting) industry.
- Technical manpower is available.
- A favorable tax structure exists at the State and local level.

To a large extent, the future economic growth of the county will reflect the national economy. The Bureau of Business and Economic Research at Arizona State University has predicted the county's economy will reflect increasing growth in Government, manufacturing, tourism, recreation activities, and the service sector. Constraints to future growth will include a slowdown of the national economy, energy restraints, enforcement of pollution standards, and the lack of development of public facilities.

5. Transportation. Maricopa County is a major transportation center in the southwest. It has railroad lines, airports, and major highways. Interstate Highways 17 and 10 connect Phoenix with Flagstaff and Tucson, and Interstate Highway 8 connects Phoenix with San Diego. A future alignment of Interstate 10 to join Interstate 17 is currently being studied; this would provide a more direct route to Los Angeles.

Over 100 transcontinental, interstate, and intrastate truck lines service the county; overnight service by truck is available to southern California and parts of New Mexico and Utah, and next-day service is provided to 10 additional states. Two railroad lines and transcontinental bus lines serve the area.

Excellent flying conditions have enabled the county to become the 24th busiest aviation center in the nation. Sky Harbor International Airport is served by 10 major airlines; it had 4,984,600 passenger arrivals and departures in 1977. Phoenix recently modernized Deer Valley Airport, located north of the city.

In 1977, the county had registered 646,006 passenger vehicles, and it had registered 969,377 total vehicles; this represents one vehicle for every 1.3 persons. This was an increase of 100 percent over the number registered in 1962.

Because Maricopa County has a low-density population and widely dispersed urban growth, an adequate public transportation system has not developed. In 1977, the county had 383 buses and 251 taxis. As additional buses have been added, passenger use has increased, but still only 0.5 percent of the total trips are made on busses.

Existing and proposed large-scale developments are not likely to become autonomous satellite cities. It is unlikely that mass transit links to the high employment areas of Phoenix will be provided, and even if mass transit were provided, it is unlikely that it would replace the automobile. Consequently, the amount of traffic moving into Phoenix will increase. In the Phoenix area, transportation planning has been conducted over the past several decades. A major street and highway plan was adopted for the area in 1961, and the Valley Area Traffic and Transportation Study (VATTS) was established as an ongoing transportation planning program for the metropolitan Phoenix area in 1965. In 1977, the Maricopa Association of Governments Transportation Planning Office (MAGTPO) completed the Phoenix Urban Area Transportation Plan, as directed by the U.S. Department of Transportation.

6. Housing. As of October 1, 1977, the Republic-Gazette survey reports the following breakdown of housing in the Phoenix metropolitan area: single family dwellings, 63 percent; multiple-family dwellings, 20 percent; townhouse units, 6 percent; mobile homes, 10 percent. The median housing value of owner-occupied single family dwellings rose from \$18,500 in 1970 to \$35,615 in 1978.

In 1977, 17 percent of the housing units in Maricopa County were substandard; these are year-round housing units economically unfeasible to rehabilitate. The ethnic communities near the Salt River in the Phoenix metropolitan area contain a large amount of this substandard housing.

Assuming conditions continue to be favorable for the construction of multiple-family dwellings, it is expected their percent of the total housing will continue to increase. Large parcels of land on the periphery of the urbanized area will continue to attract housing development. Twenty-eight planned developments (ranging from a few hundred to 5,000 persons) are now approved and under construction. Six other planned developments are approved, with a design population as high as 26,000 persons. Nine possible future large-scale developments in Maricopa County are awaiting approval. These developments total 127,421 acres (51 566 ha), with a total design population of 765,190 persons.

E. ACCESSIBILITY. The project sites are easily accessible from the Phoenix metropolitan area by paved surface roads. All sites, except New River Dam, are within close proximity to the City of Phoenix.

F. SOCIOLOGICAL PERSPECTIVE. The planning process of the recreation facilities should identify the leisure needs and preferences of the potential users. These users, who are basically urban consumers, urban areas, such as the Phoenix metropolitan area contained within the project region, make specific demands on open space development. Planning of recreation resources should recognize the needs and desires of the users they are planned to serve.

1. Recreation Land and the Urban Consumer. Recreation land should be a functional part of the overall environment, including the daily life styles of the community. Besides providing recreation opportunities, this land also preserves valuable scenic and natural resources.

The environmental resources of the project areas offer exceptional opportunities for year-round outdoor recreation and high participation rates. The unique nature of the desert, typified in the project areas, offers the urban recreationist a chance to experience the natural environment close to home.

2. The Urban Consumer. The city serves as a center of business, cultural, and social activities. These meet many of the basic needs of survival, safety, and security, and also the higher-level needs of comfort, joy, and pleasure, as identified by Maslow. Open space also can be used to achieve these higher level needs. Recreation resources are used by the urban consumer for conducting activities he either finds there or brings with him to satisfy these inner needs.

The 1978 National Urban Recreation Study identifies urban recreation needs that include the following:

- The conservation of open space for its natural, cultural, and recreation values
- The provision of close-to-home recreation opportunities
- The encouragement of joint use of resources
- The provision of environmental education and management as an integral part of recreation areas

Due to the highly developed consumer values of convenience, coupled with more leisure time and increased discretionary income, pressure is applied on the limited amount of easily accessible recreation resources available in an area. The urban consumer wants to be with people, and only occasionally seeks out-of-the-way, uninhabited places.

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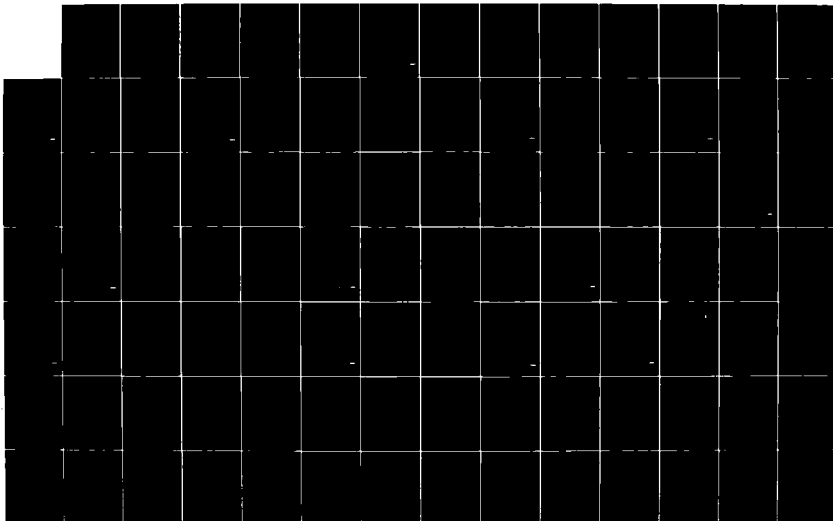
NEW RIVER AND PHOENIX CITY STREAMS ARIZONA OVERALL
MASTER PLAN(U) ARMY ENGINEER DISTRICT LOS ANGELES CALIF
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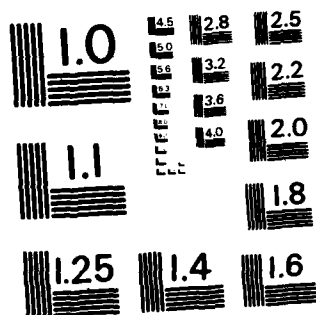
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Another developing trend in outdoor use is the desire for physical fitness. Lifetime outdoor activities (such as bicycling, jogging, horseback riding, tennis, golf, and hiking) are becoming extremely popular with the urban consumer.

Nature idealists are not typical park visitors, but they comprise a small and growing minority. These persons appreciate the natural environment for what it is rather than how it can be used, because conservation and preservation are the ideals of this group. If the trend continues, the minority of nature idealists may grow, but will not soon reach the numbers of the majority of urbanities using the outdoors as a setting for social intercourse. However, the long-range effects of the current interest in ecology have not been assessed, and a gradual shift back to the nature ideal may take place.

Conservation values can be nurtured in the park visitor through interpretive programs. Promotion of environmental awareness is possible, once the urban consumer is attracted to the park. Educational experiences then can be integrated with park use, encouraging an esthetic awareness, and a realization of the full opportunities the parks offer.

3. Recreation Activity Patterns. A recreation resource should be open to the choice of the users. A resource is meaningless unless it is specifically related to their characteristics and aspirations. Open space should be uniquely designed for those who will use it; it should include a broad range of opportunities emphasizing variety for the users' satisfaction. Recreation requires the use of diverse resources, from the highly developed site to undisturbed, primitive areas.

The AORCC provides a comprehensive framework for determining existing and potential needs and activity patterns of users in the project area. Outdoor recreation activities among the urban-oriented residents are characteristically less physically demanding, are participated in by a great number of families, and are usually one-day outings. Rising gasoline costs have restricted much of the recreation participation to opportunities in or near the urban centers of Maricopa County. The following is a quotation from the AORCC study dated December 1978: "*** 50% of the State's population believe that a need exists for the development of urban outdoor recreational forms such as hiking, bicycling and horse trails *** 35% to 45% of the State's resident population perceives a need for urban based scenic drives, motorbike and four-wheel tracks and urban campgrounds." Developing these types of activities satisfies three objectives: (a) provides for expanded outdoor recreation activities, (b) decreases urban based pressure on rural resources and facilities, and (c) helps reduce the amount of energy (petroleum products) consumed in outdoor recreation-related transportation.

As assessed by AORCC, the preferred recreation activities are sightseeing, picnicking, outdoor sports events, bicycling, outdoor zoo/museum, and pool swimming. The listing below, based on a 1978 statewide survey, indicates the percentage of households participating in each activity.

<u>Activity</u>	<u>Percentages of Households</u>
Sightseeing	38%
Picnicking	36
Bicycling	33
Pool swimming	31
Outdoor zoo/museum	29
Outdoor sports events	28
Fishing	22
Playground equipment	21
Tennis	20
Baseball/softball	19
Jogging/running	19
Lake/river swimming	17
Golf	17
Volleyball/badminton/basketball	16
Camp/no facilities	15
Camp w/facilities	14
Handball/squash/racquetball	11
Skate boarding	11
Outdoor concert/drama	10
Mountain climbing	10
Nature study	10
Football/soccer	9
Game hunting	9
Horseback riding	9
Rafting/tubing	9
Powerboat/no skiing	7
Powerboat w/skiing	6
Trailbiking	5
Canoe/sail/row	4
Horseshoes/shuffleboard	4
Archery	3
Sled/toboggan	2
Ice skating	2
Flying/gliding	2
Cross county skiing	-
Snow mobiling	-
Snow skiing	2

An AORCC needs-assessment workshop assigned priorities to present facility needs. The projected growth of population in the project area points to the necessity of planning for additional outdoor recreation facilities in these areas.

4. Factors Affecting Recreation Patterns. An analysis by H. Douglas Sessom in Outdoor Recreation for America (1972), which was corroborated by independent studies, identifies seven crucial factors affecting recreation patterns. They are discussed in the following subsections.

a. Age. Demographic information indicates the population of the county is increasing. Within this population, the largest amount of increase is occurring in the 20- to 35-year age group and is due to the present trend of southwest migration and the high birth rates in the early 1950's. Within this age group are young married couples, with children, who seek family-oriented outdoor recreation. They will be the major users of the project sites. Retired persons, with an unlimited amount of leisure time, also comprise a large share of the project users.

b. Income. Suburbanization and development of the urban fringe depend on people with regular incomes and even modest affluence. The income of the characteristic urban consumer is substantial enough to permit a variety of recreation pursuits, restricted only by family size and the ages of the children. Typical leisure play for the group is picnicking, sightseeing, pleasure driving, and family-oriented activities.

c. Education. Participation in outdoor recreation activities is partially influenced by educational experiences. Interpretive programs are one way to influence the type of use in the parks.

d. Occupation. Employment trends represent an increase in short periods of discretionary time. Much of this unobligated time will be used for outdoor recreation. This factor increases the need for additional, close to home facilities. Many industries also are contemplating the shorter work week. Consequently, an extra day for family-oriented activities--such as picnicking, sightseeing, and horse-back riding--is foreseen in the near future.

e. Residence. A distinguishing factor of Phoenix is the urban sprawl, planned, and unplanned development. This kind of growth rapidly consumes open space and decreases the potential land available for outdoor recreation facilities. The projects will eventually become conservation pockets contained within residential development.

f. Mobility. Even though transportation is available to a large segment of the population, increasing costs of gasoline restrict movement to closer-to-home urban settings for outdoor recreation. The majority of recreation visits to the projects will be all day outings destined for natural scenic areas within close proximity to the home.

g. Opportunities for Activity. The outdoor facilities will offer more than just scenic views; they are designed to provide a sense of recreation. Picnicking, bicycling, horseback riding, jogging, and camping are just a few of the possible opportunities to the urban consumer. Increasing the number of facilities available also will increase participation and future demand.

5. Summary. Maintaining natural and social science research can help determine planning decisions for outdoor recreation facilities. Monitoring research will keep planners up-to-date on recent discoveries. To date, the preceding factors have been found to affect recreation patterns.

The notion of an open declaration of service to the urban consumer is a sensible strategy. By recognizing the needs of its potentially most numerous clientele and planning for them within carefully calculated allowances, conservation becomes real and not simply an ideal.

Factors Influencing Development

Chapter 6

FACTORS INFLUENCING DEVELOPMENT

A. GENERAL. The following section identifies the constraints various environmental and social elements have on the New River and Phoenix City Streams Project's resource use planning. Limiting factors determine optimum land use development and management. These factors are of prime consideration in the proposed development plans.

B. CLIMATOLOGY. The climate of the Phoenix area is pleasant throughout the year, creating a year-round recreation season. According to the 1978 Arizona SCORP report, participation rates in outdoor recreation of residents and nonresidents alike vary only modestly by season. The high summer temperatures limit recreation participation during the warmer daylight hours. However, rather than a complete cessation of activity during the summer season, recreation participation shifts to the cooler early morning hours, evenings, and nights. It is not unusual to observe late night jogging, or early morning picnicking. The weather is rarely inclement for extended periods of time. The combination of high and moderate temperatures, low relative humidities, and a maximum amount of sunshine make possible a year-round season for outdoor recreation facilities.

C. PHYSIOGRAPHY. The topography of the project area is one of the most significant considerations in the master planning process. The steep slopes, characteristic of the damsites, will severely influence and constrain placement of facilities. The most appropriate sites for facility placement are on slightly sloping to flat areas.

Four slope categories have been identified. Generally, these groupings correspond with those selected by the U.S. Soil Conservation Service. Characteristics of the slopes are described as follows:

- 0 - 8 percent slopes: This grouping includes a large majority of the basin areas--lands associated with the Arizona Canal diversion channel, Cave Creek Regional Park, and the flowage easements along Skunk Creek and the New and Agua Fria Rivers. In relation to development, slopes in this category require little site modification. Drainage may present a problem due to ponding, but generally these areas can be developed economically.
- 8 - 15 percent slopes: A large percentage of the lands bordering the basins are within this category. These lands generally occur in side valleys, beside drainageways, and along the tops of ridges. These slopes are usually suitable for building sites, roads, trails, and public use activities. Some site modification may be required as the slope increases.

- 15 - 25 percent slopes: Almost without exception, the slope category of these lands includes those that would require some degree of site modification. As these slopes become steeper, they become less economical to use for development. However, even though areas suitable for picnic and camping are very limited on such slopes--because of construction limitations, erosion factors, and lack of accessibility--they are very desirable and visually interesting, due to the types of land forms and vantage points available.
- 25 and + percent slopes: This grouping is composed of all those lands that exist on the upland and mountain areas of the project vicinity. In addition, lands of great contrast in elevation, such as cliffs and rock slopes, fall in this category. Steep lands of the area are considered to be most difficult and uneconomical to develop, because of the extensive site design modifications that have to be employed. These include large excavation operations, drainage and erosion controls, and excessive road cuts and fills. While these land areas can be valuable for development, the scale of development is the limiting factor. Steep slopes add great scenic value, as compared with flat slopes. Consequently, these areas are excellent for small scale pedestrian-oriented overlooks and trails. Generally, slopes that exceed 20 percent must be stabilized by some form by vegetative cover.

D. GEOLOGY. Geology, as it relates to depth to bedrock, will influence the location and development of land uses to a limited extent. In general, the placement of roads, structures, and utility alignments will be governed to some degree by the location and depth of bedrock. Because of the costs, major bedrock excavation should be avoided, if possible. In the event bedrock excavation is necessary, every attempt will be made to blend the excavation to the surrounding landscape.

E. HYDROLOGY. Each feature of the project will require a thorough investigation of the particular hydrologic constraints. Generally, development, other than trails, will not occur on land frequently inundated with floodwaters. Visitor safety and the project purpose of flood control define uses consistent with these objectives. Overall, resource development will not impede the safe operation of the project lands. Due to health reasons, all comfort stations will be located above the 100-year flood elevation. Because percolation of water is relatively rapid in certain areas, potential danger of ground water contamination may exist in high permeability areas. This constraint, however, would apply to effluent discharge only. Areas with slow permeability will limit excavation and grading operations for development. In all cases, the alignment of major drainageways will be respected to preserve the integrity of these flowage areas and the vegetation surrounding them.

F. SOILS. The soils of an area will be analyzed to determine their suitability for resource development. Selecting areas suitable for development is partially dependent on the soil type. Interpretations are made on the basis of slopes, hazard of flooding, permeability texture, presence of coarse fragments on the surface, rockiness, depth of bedrock, water table level, available water capacity, salinity, and alkalinity. Three degrees of limitations are given:

Slight-restrictions--These are only minor problems, easily overcome.

Moderate--These types of limitations require careful planning and design; costs of corrections are an important design consideration.

Severe--Costs of overcoming severe limitations may be too high to justify proposed development.

The limitations do not necessarily eliminate a specific use, but a severe limitation will escalate costs in proceeding with a particular kind of recreation development. Consequently, to avoid high capital outlays, caution must be taken in siting specific activities and facilities. Whenever possible, those soils with slight limitations should be utilized. Alternately, moderate limitations may be overcome with careful planning and design. The soils within the project area vary greatly. Specific soil types and their limitations will be identified in each master plan.

G. VEGETATION. Vegetation within the project area consists of a variety of desert plants and grasses. Dispersment of the vegetation is relatively sparse, except along the drainageways. Development within the basin should retain as much of the existing vegetation as possible.

The lack of vegetation due to past uses and construction activities will require the revegetation of many areas to improve the esthetics. The protection of various native plants will be followed according to the standards established by the Arizona State Statutes.

H. WILDLIFE. Small mammals, amphibians and reptiles, and birds are quite mobile within and adjacent to project lands. In areas where significant habitat still exists, primarily the Cave Buttes and New River sites, a diversity of wildlife may be viewed. This habitat should be preserved whenever possible. Wildlife management techniques may be utilized to enhance the habitat and, hence, increase the occurrence of particular species of wildlife. The New River site may provide a unique wildlife viewing experience with the establishment of an informational and interpretive program, in conjunction with an intensive wildlife management program.

I. ARCHAEOLOGY AND HISTORY. The development of project features containing significant archeologic or historic resources will utilize these elements for the benefit of the public, while also striving to

preserve these resources for future generations. Construction activities and flood inundation will, necessarily, destroy some sites. Other representative archeologic or historic sites--particularly Cave Creek Dam and the petroglyphs at the Adobe Dam site--will become available for public viewing. An interpretive and educational archeologic program can become a primary recreation experience. This will offer the public a unique opportunity to encounter the heritage of Arizona within archeologic districts of New River, Skunk Creek and Cave Buttes (pl. 4).

J. ACCESSIBILITY. Accessibility to all the project features is available on high-standard paved roads. The project features have residential development within close proximity to their sites, with the exception of Cave Buttes, New River, and portions of the flowage easements. Considering projected growth patterns, it can be anticipated that within a few years, these sites also will become encircled by residential development. Such development will encourage the construction of additional roadways that will make the project features more accessible.

The project features also will be made accessible by trails. This is accomplished by linking proposed trails within the sites to the existing or proposed network of city and county trails.

K. EXISTING LAND USE. In all cases, the existing land uses surrounding the project features will be considered. Development will compliment these areas, while also enhancing the range of recreation opportunities available to the public. The project features commit the open space lands that otherwise might have been totally developed for residential or commercial uses. Retaining these lands as open space will augment the present city and county park system. In cases where proposed and existing parks are closely associated with the project features, facility development will respect and promote reciprocative land uses.

L. VISUAL ANALYSIS. The visual quality aspects related to the development of resources, recreation, and associated features within the project area are summarized below:

- Visually, the scale of any development will be consistent with the character of the feature as it presently exists. In essence, the activity areas should be designed to compliment and in some cases improve the esthetics of the landscape.
- Generally, the recreation value of a project depends largely on the scenic character of the area. Native stands of plant materials are valuable amenities that should be preserved and utilized in the design of facilities. Scenic vistas can be enhanced by directing views and providing appropriate facilities.

- Impacts will be made on the visual esthetics by the construction of the flood control features, roads, and parking areas. New land forms created by cut and fill operations may add or detract from the visual quality. Definite consideration will be given these elements; when possible, their negative effects will be minimized.

M. **AREA OF INFLUENCE.** The area of influence is defined as the region affected by the projects. Primarily, the facilities will be used by people within the Phoenix metropolitan area and Maricopa County, but they also will be used by tourists. Facilities provided will supplement the recreation needs of the primary area of influence; these needs have been identified by the Arizona SCORP, local recreation agencies, and the public.

N. **DEMOGRAPHIC CHARACTERISTICS.** The socioeconomic factors indigenous to a geographical area influence the demand for certain types of outdoor recreation activities.

Those demographic characteristics influencing and constraining resource development and management are discussed in the following paragraphs.

1. **Existing Population.** Ninety-five percent of the population within Maricopa County is included within the Phoenix Standard Metropolitan Statistical area, one of the fastest growing metropolitan areas in the nation. The 1978 figures from the Arizona Statistical Review show the population at 1,346,500; in 1960 the figure was 663,510. The factors contributing to this doubling of the population are natural increases, migration to the southwest, and the favorable climate. This growth in population has increased the pressure on available outdoor recreation sites in the area.

2. **Projected Population.** Projected population for Maricopa County is as follows:

<u>Year</u>	<u>Population</u>
1980	1,431,000
1985	1,629,000
1990	1,802,000
1995	2,002,000
2000	2,181,000

Because this growth pattern will continue to exert pressure on outdoor recreation sites in Maricopa County, there is a need for additional development.

3. **Age.** A 1977 consumer survey reports the median age was 27.1 years. Over 49 percent of the population is 16 to 64 years old.

The large number of young adults in the area are showing a change in recreation values. This group is becoming less achievement-oriented in recreation pursuits; they desire individual and family activities over team-type activities. With the change in focus, demand will increase for those sites offering alternative sources for outdoor recreation pursuits.

4. Income. The median income level of \$14,011 shows a high amount of disposable income for many of the region's residents. Available discretionary income increases the possibility of pursuing outdoor recreation. Figures predict continued increases in household and per capita incomes. Inflation must be taken into account, for it causes reduced real incomes and smaller household budgets for entertainment and travel.

5. Mobility. Increased mobility is evident throughout Maricopa County. There is one vehicle for every 1.3 persons. This makes travel a possibility for leisure activities, although travel restrictions such as lowered speed limits and higher-priced gasoline will restrict this travel to closer-to-home outdoor recreation sites. Energy conserving recreation pursuits will become more evident because of these factors.

6. Leisure Time. According to estimates, increased productivity will reduce the average work week to 36 hours. The three-day weekend, already created by some national holidays, and the four-day work week that eventually may be adopted by many businesses, will increase the demand for recreation activities. Available leisure time is growing; the consequences are more intensively used outdoor recreation sites and an increase in demand for diverse recreation activities.

7. Education. Learning can further the concepts of physical fitness and conservation ideals, with an increase in appeal for these types of activities.

All of these demographic characteristics show the need for more outdoor recreation facilities. People will most likely wish to pursue individual and family type outings at a minimal cost close to home. These needs influence the kind of recreation resource development proposed for the project features.

0. APPLICATION OF PUBLIC LAW 89-72 AND OTHER ADMINISTRATIVE REQUIREMENTS FOR COST SHARING. In accordance with Federal policy based on House Committee Report No. 254, which accompanied Public Law 89-72, cost sharing of recreation is required between the Federal Government and local interests. Under this policy and the memorandum dated 12 June 1976 from Victor V. Veysey, Assistant Secretary of the Army (Civil Works), local interests must perform the following requirements:

- Acquire in its the name and dedicate to public outdoor recreation use for the economic life of the basic flood control improvements all lands needed for recreation development and to insure public control of the development. Recreation developments will be provided within the lands acquired by local interests for the basic flood control project only, except as may be required for access, parking, potable water, sanitation, and related developments for health, safety, and public access. Credit is given for lands, as indicated below.
- Where the appraised value of the land, as described above, amounts to less than 50 percent of the total first cost of the recreation development, make additional contributions sufficient to bring the non-Federal share to at least that level; additional contributions may consist of the actual cost of carrying out an agreed-upon portion of the development, or a cash contribution, or a combination of both.
- Operate, maintain, and replace without expense to the Federal Government the recreation areas and all facilities installed pursuant to the agreement.
- Share in the cost of mitigation of damages caused by recreation development, as these are joint costs and will be allocated to the responsible parties of the project in the same way as other joint costs.

Local responsibilities with regard to the cost sharing agreement will be addressed in the individual master plans.

Chapter 7

COORDINATION WITH OTHER AGENCIES

During the development of the master plan for the New River and Phoenix City Streams project, close and continuous coordination has been maintained with Federal, State, and local agencies that have interests and responsibilities in the fields of public recreation, fish and wildlife, preservation of archeologic and historic resources, and environmental quality. A multiagency recreation task force was formed in September 1973 for the purpose of planning and coordinating recreation development associated with the New River and Phoenix City Streams flood control project. The task force is composed of representatives of various Federal, State, and local agencies and interest groups, including the following:

- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- U.S. Soil Conservation Service
- U.S. Water and Power Resources Service (formerly
U.S. Bureau of Reclamation)
- Arizona Game and Fish Department
- Arizona Outdoor Recreation Coordinating Commission
- Arizona State Horsemen's Association
- Arizona State Land Department
- Arizona State Parks Department
- Arizona Water Commission
- Flood Control District of Maricopa County
- Maricopa County Parks and Recreation Department
- Maricopa County Planning Department
- Avondale Parks and Recreation Department
- Glendale Parks and Recreation Department
- Mesa Parks and Recreation Department
- Peoria Parks and Recreation Department
- Phoenix Parks, Recreation, and Libraries Department
- Tempe Parks and Recreation Department
- Deer Valley Community Council
- Deer Valley Planning Committee
- Jade Park North Homeowner's Association
- Saddleback Meadows Homeowner's Association

The task force has been actively involved in the planning of recreation facilities associated with flood control in the Phoenix metropolitan area. Task force members studied several alternative plans for each of the dam sites, made site investigations, and recommended water-based recreation at Dreamy Draw, Cave Buttes, and Adobe Dam sites. Because of the high cost of water to fill and maintain the lakes, no single agency or combination of agencies could sponsor development for water-based recreation development at Dreamy Draw, Cave

Buttes and Adobe Dam sites and for wildlife preservation at the New River Dam site. During all task force meetings, the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service favored preservation of the New River area for wildlife habitat.

The task force met with the Maricopa County Hiking and Riding Trails Committee to discuss plans for a trail system along the Arizona Canal diversion channel. The committee reviewed the plans for the trails, street crossings, and esthetic treatment; they recommended that a swale concept be considered for some segments of the channel. The Arizona Conservation Council concurred in this recommendation and suggested the use of land sculpturing and native plantings to minimize the linear mode of the channel.

The task force recommended development of a recreation parkway from Cactus Road to Skunk Creek and a linear park along Cave Creek from Cave Buttes Dam to the diversion channel. The planning of the parks has been coordinated with plans for the trail system along the diversion channel.

In addition to the close coordination with the recreation task force, the overall land use concepts and development plans have been presented to the Arizona Conservation Council, Citizen's Advisory Board of the Flood Control District of Maricopa County, Maricopa County Board of Supervisors, Arizona Hiking and Equestrian Trails Committee, Maricopa County Hiking and Riding Trails Committee, Maricopa County Parks and Recreation Commission, Deer Valley Planning Committee, Paradise Valley Planning Committee, City of Phoenix Parks and Recreation Board, and Phoenix City Council. In general, these groups are in support of the overall conceptual plans. The recreation concepts were presented to the AORCC and the Heritage Conservation and Recreation Service, Pacific Southwest Region. These agencies agreed that the plans do not conflict with any of the current or proposed recreation projects.

Coordination with the recreation task force and other interested parties will be continued throughout all future phases of planning, development and implementation of the New River and Phoenix City Streams recreation development plan.

**Resource Use
Objectives**

Chapter 8

RESOURCE USE OBJECTIVES

Resource use objectives have been established utilizing input from the Recreation Task Force, local sponsors for recreation and flood control, citizens' groups, environmental organizations, and government agencies. The stated resource use objectives are in concert with the natural and man-made resources of the New River and Phoenix City Streams project area. The objectives are in keeping with four general environmental goals stated in 33 CFR Part 230 (ER 200-Z-Z) Environmental Quality: Policy and Procedures for Implementing the National Environmental Policy Act. The goals are:

- To preserve unique and important ecological, aesthetic, and cultural values of our national heritage
- To conserve and use wisely the natural resources of our nation for the benefit of present and future generations
- To restore, maintain, and enhance the natural and man-made environment in terms of its variety, beauty, and other measures of quality
- To create new opportunities for the American people to use and enjoy their environment

The resource use objectives for the New River and Pheonix City Streams project are listed in the following subsections.

1. To maintain and protect riparian, desert outwash, and desert upland vegetation supported by desert washes and streams within reservoir basin areas for their open space, esthetic, and wildlife habitat values

(Discussion) The three types of plant communities--riparian, desert outwash, desert upland--present a diversity of habitat and thus will support both a variety and abundance of wildlife. As the Phoenix area experiences increased development, the reservoirs will remain valuable areas of wildlife habitat and open space.

2. To manage and preserve open space and wildlife habitat values within flowage easements along Skunk Creek and New and Agua Fria Rivers

(Discussion) The continued urbanization of Phoenix stresses the importance of preserving open space and wildlife habitat along these three major drainageways in the western Phoenix region. Flowage easements will prevent unrestricted urban development and allow these reaches of Skunk Creek and New and Agua Fria Rivers to retain some

natural characteristics. The conservation groups strongly support the natural state as the open areas and diversity of vegetation provide valuable resources--nesting, resting, roosting, protection, feeding--for the area wildlife. There is a direct relationship between abundance of open space/vegetation and wildlife; as one diminishes, so will the other. Open space and vegetation will become increasingly important natural areas to residents of the Phoenix metropolitan area as urbanization continues to eliminate such areas.

3. To preserve wildlife habitat within mitigation areas along the Gila River and to manage those areas by Arizona Game and Fish Department

(Discussion) The U.S. Fish and Wildlife Service and the Arizona Game and Fish Department evaluated the effects of the construction of the entire project on fish and wildlife values. Project construction will destroy or modify riparian and desert outwash vegetation. To compensate for this loss, a parcel of land was acquired in the Gila River flood plain and is being managed by the Arizona Game and Fish Department.

4. To establish a cultural resources interpretive program for the protection, study, and viewing of unique cultural resources on project lands

(Discussion) A cultural resources survey was made of the entire project area. Many sites were discovered and determined to be eligible for inclusion in the National Register of Historic Places. Special efforts were taken by the Corps and other agencies to preserve a petroglyph site downstream of Adobe Dam. A memorandum of agreement between the Arizona State Historic Preservation Office, the Advisory Council on Historic Preservation, and the Corps contains provisions for an extensive program of data recovery, preservation, and interpretation of the sites. Plans are being formulated in which the petroglyph site at Adobe and portions of significant Hohokam sites at New River will be preserved, protected, and integrated into the recreation program.

5. To make project lands available for the development of a comprehensive trail system (hiking, bicycling, and horseback riding)

(Discussion) The State of Arizona and Maricopa County have regional preserves and parks that are adjacent to several of the New River and Phoenix City Streams project features. In cooperation with the State of Arizona and Maricopa County, regional bicycling, hiking and equestrian trails have been planned for the basin areas, the mountainous areas, and along the channel rights-of-way. A survey taken by the AORCC and several surveys conducted by the State of Arizona have identified trail activities as high priority needs among the residents of the project market area.

6. To utilize project lands to provide high quality recreation facilities with a variety of high and low density activities consistent with the objectives of protecting cultural resources, esthetics, open space, and wildlife habitat

(Discussion) The Arizona SCORP, through an inventory of recreation supply and a survey of participation, assessed the outdoor recreation needs of Maricopa County. The needs assessment was utilized in planning the recreation features of the New River and Phoenix City Streams project. To avoid duplication of facilities, a Recreation Task Force was established. The Task Force recommendations and plans of other governmental bodies were considered in the preparation of developmental plans for the project area.

7. Whenever safe, practical, and consistent with the objectives of protecting cultural resources, esthetics, open space, and wildlife habitat, to utilize project lands for needed overnight facilities

(Discussion) The SCORP identified camping as the seventh highest priority need for recreation activities or facilities within the State. Local sponsors have asked that the Corps cost-share development within project lands to meet the growing demand for such facilities. The New River and Phoenix City Streams project features, close to major highway arteries, provide easy access to overnight facilities. The project lands, which are close to the Phoenix metropolitan urban center, are in desirable locations.

8. To consider, and (when deemed necessary) to implement esthetic treatment of all construction related activities, including operation and maintenance activities

(Discussion) Public concern has been expressed about the preservation of natural beauty. The Maricopa County Parks and Recreation Commission and the Flood Control District of Maricopa County have adopted general policies for esthetic treatment and landscaping of flood control structures that concur with the Corps policy of esthetic treatment for flood control structures. Every consideration will be given to planning and designing channels, dikes, levees, floodwalls, and dams so that they blend in with and create a minimum adverse impact on the surrounding environment.

9. To consider resource mining (including, but not limited to, topsoil, sand and gravel, precious metals, petroleum, geothermal) only when determined the activity is consistent with all above-stated objectives

(Discussion) Consistent with all Corps of Engineers land use objectives and policies, the extraction of resources may be allowed, and is deemed appropriate, only if it does not preclude other uses of the lands for cultural, esthetic, recreation and open space needs. Extractive resource mining generally poses irreversible changes in topography and causes long term changes in vegetation and fish and wildlife habitat values. In keeping with established natural resource management techniques and policies, extractive resource sites will be recontoured and revegetated to mitigate the air quality, water quality, vector control, and associated human health and safety problems.

10. To design recreation facilities, including landscaping, that can tolerate periods of flooding and inundation without serious damage

(Discussion) The four dams in the project are designed to hold water only during times of floods. The effects of even temporary impoundments can be damaging to recreation facilities if they are not properly designed. Additionally, location of structures and certain types of vegetation will not be appropriate in areas where significant deposition of silt and debris is anticipated.

Land Use Planning

Chapter 9

LAND USE PLAN

Land use plans will be in accordance with legislative authorities and project authorization. Plans for development and management of resources within the project area will be prepared with full consideration of the requirements of the National Environmental Policy Act of 1969 (Public Law 91-190). Allocation of land uses and determination of management policies will be developed in conjunction with the local recreation sponsors to ensure compatibility, flexibility, and optimum use of resources.

Ultimately, a land use plan should be based on the physical characteristics of the land area being considered. The physical features influence development in terms of siting. Severe site limitations, due to physical features, will increase the costs of development and may create hazards in unstable areas. The project areas at Dreamy Draw, Cave Buttes, Adobe, and New River Dams are typically broad desert valleys traversed by desert washes and constricted by slight to steep mountain slopes. These three distinct landscape types provide the basis for a land use plan.

At this point, a distinction will be made between the dam features, flowage easements, and channelized portions of the project. The locations of each dictate the development of different land use plans.

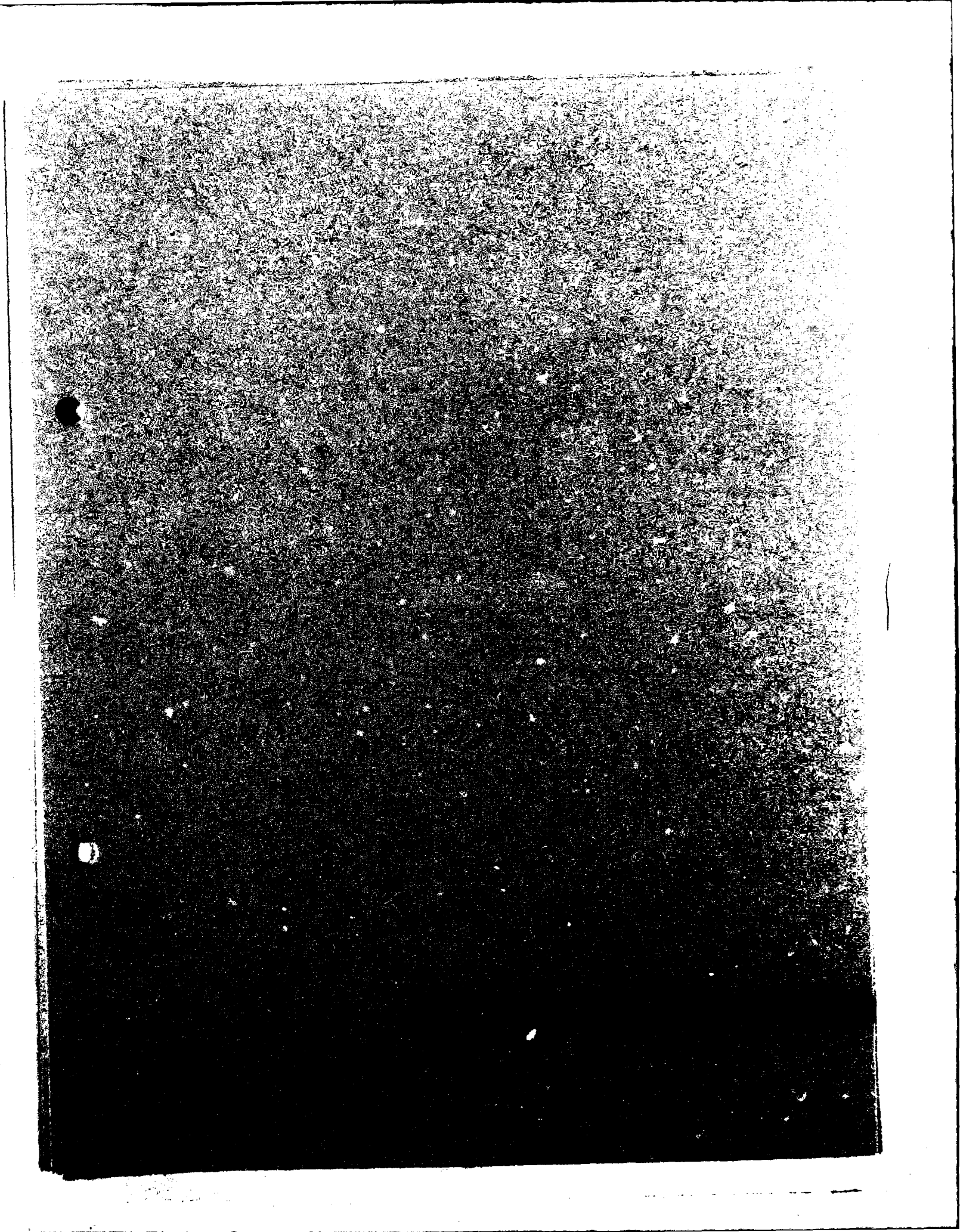
The relatively flat desert floor poses the least restrictions for development. Flood elevation restrictions, soil types, climatological data, and other environmental factors need consideration before final siting decisions are made.

The native riparian vegetation supported by the desert washes is a positive natural feature contributing to a pleasant environment within the basins. The natural integrity of the plant species and wash alignment will be respected. Facility development can utilize these features advantageously, while also considering the limitations of the flood hazard and soil types. Wash areas may limit and buffer activity areas.

Due to steepness of slopes and the rock outcrop conditions, facility siting on mountain slopes is severely restrictive. Slight to moderate slopes may be utilized for development in cases where the limiting factors are slight. Steeper slopes may be suitable only for trail development. Mountain slopes may act as open space or buffer zones between uses.

Land use plans for flowage easements and channelized portions of the project area are dependent on the associated land uses, flooding restrictions, steepness of sideslopes, and the total area within the right-of-way. The linear qualities of these features will be used to the maximum possible extent.

Overall, the land use plans will represent a synthesis and analysis of the environmental, social, and economic factors present within and around the project features.



Chapter 10

PHYSICAL PLAN OF DEVELOPMENT

A. GENERAL. The New River and Phoenix City Streams project offers the unique opportunity to develop outdoor recreation facilities within close proximity to the urban population of the Phoenix metropolitan area. "The greatest opportunities for meeting future recreation demands exist in our immediate rural areas--that is, in the areas between the urban concentrations and the purely resource-based areas, such as mountains and seashores."¹

The project sites are primarily in rural areas or on the urban fringe. Appropriate recreation use will be concentrated in five major areas, securing a portion of the quickly vanishing open space around the City of Phoenix.

A Maricopa County study identifies the flood control areas as "recreational prospects...ideally suitable for open space use."²

The basic steps taken and elements considered during the planning process for the project areas include:

- A determination of recreation demand for the Phoenix metropolitan area
- An inventory of the supply of recreation opportunities in and around Phoenix
- An examination of the environmental factors affecting the project features
- Analysis of the above mentioned elements to determine specific site planning objectives

¹Elements of Outdoor Recreation Planning, ed. B.L. Drive (Ann Arbor: U. of Michigan Press, 1970) page 56.

²Maricopa County Planning and Zoning Department, A Park, Recreation, and Open Space Study, September 1979, Page 88.

The overall goal for the entire project is to provide outdoor recreation opportunities that are complementary and mutually supportive. Enhancement of these opportunities is achieved by eliminating conflicts, while also providing interpretive, informational, and safety features for the recreationist.

The Arizona SCORP through an inventory of recreation supply and a survey of participation, assessed the outdoor recreation needs of Maricopa County, of which the Phoenix metropolitan area is a part. The needs assessment was utilized in the recreation planning process to avoid unnecessary duplication of facilities. Identification of needs will assure the proposed facilities will partially fulfill the present deficit in supply.

Discussion and analysis of outdoor recreation objectives with local recreation agencies ensured coordination of planning activities for the proper siting and development of the proposed New River and Phoenix City Streams resources. Input from the community also provided valuable suggestions for the types of uses desired by the public. Existing and projected city and county land uses also were considered in the physical plan of development, to make sure resource uses were compatible with other land uses in close association to the damsites and along the Arizona Canal diversion channel and flowage easements.

The Recreation Task Force recommended the flood detention basins be utilized to reduce recreation facility deficiencies within the market area, as identified by the AORCC'S SCORP document.

The Arizona Game and Fish Department proposed that the New River Dam site be left in its natural state as a wildlife area.

Recreation opportunities for reaches of the proposed Arizona Canal diversion channel were studied concurrently with the flood control investigations. As various channel types were studied for each of the reaches, corresponding recreation potential analyses were prepared. The recommended plans for recreation along the channel reaches reflect the most feasible recreation uses of available lands. In general, the corridors established by flood control channels are best suited for the development of trail systems.

The construction of Dreamy Draw, Cave Buttes, Adobe, and New River Dams will offer valuable opportunities to develop recreation facilities to meet the needs of residents of the Phoenix metropolitan area. The relatively flat, undeveloped basins upstream from the recommended damsites are well suited to a variety of recreation activities that cannot be enjoyed in the mountainous regional parks in the vicinity. The diverse recreation activities planned for the project sites will conform to Corps of Engineers regulations and local standards.

The proposed recreation areas are incrementally necessary and complete, while also functioning as a complementary system supplementing identified recreation needs of the area. The general plans for development are described in the following paragraphs.

B. DREAMY DRAW DAM. The Dreamy Draw basin is surrounded on all sides by the 7700-acre (3116-ha) Phoenix Mountains Preserve. The Master Plan for the Phoenix Mountains Preserve, prepared by the City of Phoenix, calls for development of outdoor recreation and education facilities that are compatible with open space values. Less than 7 percent of the preserve area will be developed. Development at the preserve will include a scenic drive with overlooks, a nature study center, picnicking areas, neighborhood parks, and an equestrian center that will be located near Dreamy Draw Dam. Since hiking and riding trails in the preserve will extend northwest, south, and east of Dreamy Draw, the site is a desirable location for a trail ride assembly area.

The City of Phoenix has already developed an access route to the downstream area of Dreamy Draw Dam from the recently completed Paradise Valley Access Relief Road. Tunnels constructed under 19th Street, Dreamy Draw Drive, and the Paradise Valley Access Relief Road provide access to Dreamy Draw from the Phoenix Mountains Preserve. One of these tunnels can accommodate automobiles. Informal vehicle and trailer parking for the assembly area will provide access to the basin area.

A group ramada site with 20 tables and barbeques will serve as a meeting place where riding groups can assemble, enjoy meals, and plan rides. A multipurpose court, fire rings, horse tie-ups, and a horse watering trough also will be located near the group picnic site. Located above the 100-year flood elevation, the ramada site affords a good view of the basin. Areas of irregular topography and natural growth make picturesque and relatively secluded locations for three individual ramadas nearby. These sites will be used by small groups and by hikers, joggers and equestrians passing through the Dreamy Draw area. A tunnel will be constructed so that riders can cross under Northern Avenue and enter the Dreamy Draw Dam basin from the northern portion of the Phoenix Mountains Preserve. Rest room facilities will be provided for the convenience of recreationists using the Dreamy Draw Dam area. All of the items planned for the Dreamy Draw basin will be cost shared with the City of Phoenix.

The current plan for development of the Dreamy Draw Dam area will be further discussed in the Master Plan and Feature Design Memorandum, Design Memorandum No. 5 (pl. 9).

C. CAVE BUTTES DAM. Cave Buttes Dam is about 0.7 miles (1.1 km) below the existing Cave Creek Dam and about 10 miles (16 km) north of central Phoenix in the southern portion of the Union Hills. A two-phased recreation development is planned for Cave Buttes.

The Cave Buttes detention basin is well-suited for activities that require large areas of relatively flat land. The initial phase of development will include nonurban type recreation facilities (pl. 10a). These facilities will require a low capital investment and low maintenance. All of the initial recreation development will be cost shared with the local sponsor. An exception is Jomax Road leading to the overlook structure that will be provided at the Federal Government's cost.

The Cave Buttes area is currently used for informal equestrian activities. Cave Creek, known as horse alley, is used as a route to riding trails north of the damsite area. The recreation plan will officially designate approximately 300 acres (121 ha) in the northern part of the detention basin as an open riding and combined training area. Riding clubs could use this area as a meeting place and point of departure for organized trail rides. Trail systems through areas of dense desert-wash vegetation and sandy streambeds will be provided for equestrians and nature observers to penetrate esthetically pleasing and diverse environments. The trails in the basin will connect with existing and proposed trails located north and south of the site. A paved automobile road with a bikeway will afford easy access to the proposed recreation facilities.

Field-dog training organizations in the Phoenix area have expressed the need for open space designated for field-dog training. The area immediately upstream from the proposed Cave Buttes Dam is a suitable location for retriever dog training, while the area upstream of Cave Creek Dam on the west side of the basin will be used for pointer dog training activities.

A group camping area will be located above the 50-year flood elevation adjacent to scenic drainage areas. Individual walk-in camping will be provided in the less accessible northeastern-portion of the basin.

A multi-purpose field will be provided within the northern area of the basin. This unturfed area may be used by groups for such activities as dog shows, equestrian events, rock shows, and hot air balloon launching. The site will be turfed in Phase II.

Model airplane flying is an existing activity at the borrow area immediately north of dike no. 2. This use will continue in Phase I with the space improved by the addition of a paved runway and parking area.

The top of Cave Buttes Dam will be used by hang glider pilots in training as a practice take-off point. Pilots will take off over the downstream face of the dam; they will land 500 feet downstream.

Cave Buttes Dam will be Arizona's main center for equestrian combined training (three day events). Space will be available for temporary corrals and arenas, and horse trailer parking. These events will be held four or five times a year. At other times, supervised practice jumping will occur.

Picnic facilities are planned in a centrally located area of dense, hosque vegetation. Large mesquite and ironwood trees will provide a cool and scenic environment for picnic sites. Ramadas will be designed to have minimal visual impact on the natural landscape, and existing vegetative materials will be utilized for spatial definition, shade, and esthetic enhancement.

Rest room facilities will be positioned for user convenience throughout the recreation area. Access to facility areas will be provided by paved and unpaved roads, and, in locations convenient to the major recreation areas, parking areas will be provided.

An overlook structure and sun dial have been completed at flood control costs, as part of the Cave Buttes Dam construction contract. These features are located on a hill east of Cave Creek Dam. They provide a view of the historic Cave Creek Dam and panorama of the entire basin. The overlook also will serve as an observation point for viewing equestrian, balloon launching, and dog-training activities.

The second phase of recreation development will occur as demand warrants and urbanization encroaches on the lands surrounding the basin (pl. 10b). At this time, more urban facilities will be provided in conjunction with existing facilities. The majority of the future development will be cost shared with the local sponsor. Exceptions are mentioned in the text. Field and target archery is planned for the far west side of the basin. Additional centrally located picnic sites will be furnished to meet increasing demand.

A park center will house visitor information and a snack bar; it will be located adjacent to the recreation half of a proposed wildlife/fishing and boating lake. Each of the facilities will be provided without Federal participation. Boat launch facilities and a bait shop also will be in this vicinity and will be built without Federal participation. The western half of the lake will be devoted to wildlife enhancement. Extensive plantings of desert wash type vegetation on the western side of the lake will provide food and cover for wildlife. The wildlife half of the lake and its shoreline will be cost-shared as wildlife enhancement (75 percent Federal, 25 percent local). A nature trail and picnic area adjacent to the wildlife area will be cost shared as recreation.

Intensive recreation use will occur in and around the park center and lake. Active sports facilities, such as multipurpose playing courts and athletic fields, will sustain the growing urban demands for these

facilities. Recreation vehicle parking and campsites will be developed immediately north of dike no. 2 and south of the access road. The existing model airplane flight area may be modified in this phase if needed. This area was highly disturbed during construction of the dike and was revegetated with native plants as part of the flood control contract. Placed north of Jomax Road above the recreation vehicle area will be a locally developed golf course with a clubhouse. Additional parking and rest room facilities will be provided throughout the basin.

The Master Plan and Initial Development FDM for Cave Buttes Dam, Design Memorandum No. 6 will detail development plans.

D. CAVE CREEK REGIONAL PARK. Inasmuch as discharges from Cave Buttes Dam flow down Cave Creek, and flood plain management is a project requirement along Cave Creek to the Arizona Canal, participation in the development of project-oriented recreation features along Cave Creek was considered desirable. However, during review of the Phase I Design Memorandum, it was determined that no policy currently exists to permit Federal cost sharing of recreation development in nonstructural flood control areas. The development plan for the nonstructural portion of Cave Creek (Cave Buttes Dam to Peoria Avenue), as well as that of the structural portion (Peoria Avenue to the Arizona Canal diversion channel), will continue to be included as part of the Cave Buttes Dam Master Plan and Initial Development FDM, Design Memorandum No. 6.

The channelized reach of Cave Creek from Peoria Avenue to the Arizona Canal diversion channel is eligible for recreation cost sharing. The greenbelt area upstream of this reach is included in the planning process because it provides a cohesive and necessary link between the recreation development planned for Cave Buttes Dam and the Arizona Canal diversion channel. In the event cost sharing policies are modified to permit Federal recreation cost sharing in nonstructural flood control areas, the Corps of Engineers may be able to participate in the development of the entire wash (pls. 11a-d).

As previously mentioned, recreation development along the structural portion of Cave Creek from Peoria Avenue to the Arizona Canal diversion channel is eligible for cost sharing with the Federal Government (pl. 11d). Proposed recreation development within this reach that can be cost shared include a 15 acre recreation area adjacent to the Arizona Canal Diversion Channel, picnicking facilities, portions of a scenic drive, riding and hiking trails that enter the site, and outdoor exhibits for a nature study center.

The remainder of the nature study center--consisting of indoor exhibits, meeting areas, research and study facilities--is planned without Corps participation. A maintenance yard is also planned within the site at local cost. An existing greenhouse complex south of Peoria Avenue has been acquired without Federal participation.

The recommendation of flood plain management along Cave Creek will have the advantage of enabling local interests to realize their plans for a linear park along the wash. The 1990 land use plan for the City of Phoenix designates Cave Creek Wash from Cave Buttes Dam to the Arizona Canal as a regional park.

The City of Phoenix has already acquired approximately 450 acres (182 ha) along the wash between Greenway Road and the Arizona Canal for the purpose of recreation development. Stimulated by proposed recreation development along the Granite Reef aqueduct east of Cave Creek Road, the city plans to acquire additional acres along the wash north of Greenway Road so that Cave Creek Regional Park could extend north to Cave Buttes Dam, thereby connecting to the recreation facilities along the aqueduct and behind Cave Buttes Dam.

Cave Creek Regional Park will provide recreation facilities for users from adjacent neighborhoods, as well as recreationists from the entire Phoenix area. Because the park will adjoin several residential subdivisions that have no space reserved for recreation, small parks have been planned in selected locations. Other facilities, such as an outdoor education center and a scenic parkway, will attract users from more distant parts of the city. Facilities at the park will include picnic sites, playgrounds, multipurpose court games, athletic fields, a nature study center, golf course, swimming pool, archery, wildlife preserve, orchard, petroglyph viewing, amphitheater, equestrian center, and model boating. Trails for hikers, joggers, bicyclists, and equestrians will thread the entire length of Cave Creek Regional Park. These trails will connect to those planned for the Arizona Canal diversion channel, Union Hills Park, the Granite Reef aqueduct, and Cave Buttes Dam. Rest room facilities will be conveniently located throughout the park.

F. ADOBE DAM. Adobe Dam will be constructed on Skunk Creek in the Little Deer Valley between the southern Hedgepeth Hills and Adobe Mountain. The site of the proposed Adobe Dam recreation area is surrounded on three sides by one existing and two proposed regional parks. Thunderbird Park is contiguous to the site, and the proposed Deem Hills Park and Skunk Creek recreation area will be located just north and east of the project site, respectively.

To assure continuity in planning and design, the Adobe area and Thunderbird Park have been planned as a single unit. Thunderbird Park is being developed by Maricopa County without Corps participation, and recreation facilities in the Adobe reservoir area will be cost shared. The two areas contrast in physiographic character. Thunderbird Park is rugged and mountainous; it is vegetated with grasses, perennial shrubs, and cacti. The Adobe site is flat and sparsely vegetated. This topographic variety presents the opportunity to develop facilities for diverse types of recreation activities.

The gentle and steep slopes and graceful, narrow valleys in Thunderbird Park are particularly well suited to the development of hiking and riding trails. A network of trails will traverse the mountain slopes and lead to peaks where scenic overlooks will be located. Picnic areas are in one of the valleys where an amphitheater has been constructed. Another valley in Thunderbird Park will be the site of a par three, nine-hole golf course. Other features planned by the county for Thunderbird Park are a recreation complex and a park headquarters.

The recreation complex in Thunderbird Park will be located adjacent to the south park entrance on 59th Avenue. This area will consist of high-density recreation facilities, because of its close proximity to the urban area and the fact that there is no other facility of this nature or size to satisfy the immediate recreation needs. Other major features of the park will be concentrated in this particular location because it is easily accessible to the surrounding urban communities. Space will be available for arts and crafts classes, along with public functions and activities at the civic center. The county's plan for Thunderbird Park also includes a recreation clubhouse that will serve as the hub for court games and regulation tennis matches. Other facilities in Thunderbird Park will include handball courts, shuffleboard, horseshoes, practice tennis courts, and tournament tennis courts with bleachers.

The Adobe Dam site consists of relatively level land and is bordered on the west by the Hedgepeth Hills. The site is suitable for a variety of recreation uses. The recreation concept is to phase the development to meet the recreation needs of an increasing population in the immediate area of the Adobe Dam site (pl. 12). Facilities developed first will be regional in appeal; as the Phoenix urban area grows to encroach on the site, more intensive use facilities, such as multiple-use courts and athletic fields, will be added. A group picnic area and a group camping area, located near the western perimeter of the site and adjacent to Thunderbird Park, will be the first element of the plan to be constructed. These facilities will be cost shared with the Federal Government.

The camping facilities will be located in a secluded area that is surrounded on three sides by steep mountain slopes. There will be two group campsites, each to accommodate 100 campers as well as individual campsites. Campers could enjoy using hiking and riding trails that would connect with the network of trails planned for Thunderbird Park.

A picturesque area at the base of the Hedgepeth Hills has been chosen for the location of picnic facilities. The area has an eastern exposure, contains a variety of vegetative materials, and is the site of a rustic, old windmill that adds historic flavor to the area. Each of two large group picnic sites will contain about 20 shaded tables and large barbecue grills. Picnic sites also will be provided for smaller

groups; these sites will contain ramadas with tables and cooking grills. Ramadas will be designed and situated to provide maximum privacy and to harmonize with existing contours and vegetation. Whenever necessary, plant materials will be added to provide additional shade and enhance the visual environment.

A nature interpretive area is planned southeast of the picnicking facilities in the locality of an existing mesquite bosque. Development will include trails and seating for nature interpretation and observation. Costs for the area will be shared with the Federal Government.

A recessed area northeast of the spillway saddle and adjacent to the nature interpretive area is the site for a target archery range to be cost shared with the Federal Government.

A multi-use complex funded by Maricopa County is proposed for the Adobe Dam basin. It will be located in the northeast portion, south of Pinnacle Peak Road. Proposed facilities at the complex include an equestrian center with an enclosed arena, smaller open air arenas, corrals, training rings, and facilities for spectators.

The Land Use Plan for 1990, prepared by the City of Phoenix Planning Department, shows that residential development in the vicinity of Adobe Dam will reach densities of up to five housing units per acre. According to local standards, community-park type facilities, such as athletic fields and multipurpose courts, should be provided within a 5-minute travel time of each housing unit and should service a population of approximately 20,000 persons. By 1990, the population within 5 minutes of Adobe Dam will well exceed 20,000 persons. The Park and Recreation Plan for Phoenix, Arizona (1978) states that man-made barriers to movement (such as freeways, and, in this case, the dam) generally do not impede trips to the site; a more important consideration is the time required for the trip to the site. Black Canyon Highway, 35th Avenue, and Pinnacle Peak Road provide access to the site.

Facilities that will be developed at Adobe Dam by 1990 are to be cost shared with the Federal Government and include a children's play area, active sports areas, multipurpose exhibition fields, and additional picnic areas. A sports area north of the dam will include multipurpose courts and playfields. Picnic sites will be provided in a tree-shaded area adjacent to the sports facilities. A children's play area will be located nearby and will contain a variety of play apparatus. Multipurpose exhibition fields will be positioned near the center of the basin. The turfed fields will serve as grounds for numerous exhibition-related recreation activities such as dog shows and polo competition. Other picnic areas contain individual sites, as well as small group picnic areas accommodating about 25 persons. The picnic sites will be situated around turfed athletic fields that could be used

for informal play, as well as for organized games of hockey, soccer, or football. Landscaping materials will be used to define spaces and to enhance the esthetic appearance of the picnic and playfield areas.

The expansive area in the center of the Adobe site will be the location of an 18-hole professional golf course, developed by the Maricopa County Parks and Recreation Department. The golf course will be part of a larger complex that will include a clubhouse, a driving range, and a nine-hole golf course in a scenic valley in adjoining Thunderbird Park.

The borrow area immediately upstream from the dam will be planted with native vegetation at flood control cost. This area will serve as a corridor for a hiking and riding trail (cost shared in its development) that will connect Thunderbird Park to the Skunk Creek landfill recreation area. Cost shared paved bicycle trails will be constructed when the sports and playfield areas are developed.

Access roads and parking facilities for the Adobe Dam recreation area will adequately accommodate park visitors. All activity areas will have conveniently located rest rooms. Maintenance equipment will be stored in a maintenance yard near the intersection of Pinnacle Peak Road and 43rd Avenue. This is also the location of an existing residence that will remain onsite as a park host facility.

Two Federally funded facilities are also planned for inclusion within the basin. A visitor information kiosk facility is planned south of the maintenance yard and will be used to familiarize park users with the area's recreation development, flood control features, natural history, and archeology. A petroglyph viewing site will be provided on the southeast end of the Hedgepeth Hills adjacent to the outlet works in the locality of a significant archeologic resource. This site will be the focus of a cultural resource interpretive program presently in the planning stages. A detailed description of the kiosk facility and the cultural resource interpretive program, along with cost estimates, will be included in separate documents that are forthcoming.

The Master Plan and Initial Development FDM for Adobe Dam, Design Memorandum No. 7, will present a more thorough explanation of the proposed development plan.

P. NEW RIVER DAM. While no definitive land use plan has been formulated for the New River Dam site, the Recreation Task Force has recommended the site be left in its natural state for use as a wildlife habitat area (pl. 13). In the preparation of the land use or Master Plan for New River Dam, Design Memorandum No. 8, the environmental, social and economic factors affecting uses at the damsite will be reanalyzed by the Corps of Engineers and the Recreation Task Force. This is necessary because significant changes in the aforementioned factors, especially urban growth of the surrounding lands, may alter previously proposed land uses.

Design Memorandum No. 8 will examine the need for trails and facilities for the New River Dam wildlife area.

G. ARIZONA CANAL DIVERSION CHANNEL. The proposed Arizona Canal diversion channel, which will run north of and approximately parallel to the Arizona Canal from 40th Street westward to Skunk Creek, will have three types of channels: a concrete rectangular channel, a concrete trapezoidal channel, and an unlined trapezoidal channel. The rectangular concrete channel will be a covered box in the area of the Sunnyslope High School athletic field; a concrete trapezoidal channel is planned from Cave Creek to approximately Cactus Road, an unlined trapezoidal channel will extend from Cactus Road to Skunk Creek. The Arizona Canal diversion channel will be constructed a minimum of 50 feet (15 m) north of the Arizona Canal along the canal right-of-way. The Salt River Project, operator of the canal, has agreed to allow joint use of the northern 15 feet (4.6 m) of the right-of-way as a service road for channel maintenance.

The construction of the Arizona Canal diversion channel will present a valuable opportunity to develop recreation trail systems. In a similar situation, the Maricopa County Parks and Recreation Department has already designated a trail alongside the Arizona Canal, the Sun Circle Trail.

As the interest in riding for both recreation and transportation continues to grow, the need for safe bicycle, jogging, and equestrian trails increases.

The proposed bicycle trail, which will be designed and constructed with maximum concern for safety, will not only serve recreation needs, but also will provide opportunities for pollution-free transportation. Points of interest located within immediate proximity of the proposed trail system include several public parks and recreation facilities, such as Cortez Park, Sunnyslope Swimming Pool, and Metro Center (a large shopping complex located adjacent to Black Canyon Highway).

The bicyclists and joggers will use the paved service road provided along the north side of the diversion channel. The unpaved service road along the south side of the diversion channel also will serve as a trail for equestrians and hikers. Both roads are provided at flood control cost.

Safety has been a prime consideration in the planning of the trail system (pls. 14a-d). The trails will dip into the channels at most major traffic arteries so that recreationists may travel several continuous miles without stopping for automobile traffic. Three 0.5 acre (0.20 ha) rest areas, eligible for Federal participation, will be provided along the channel at approximately 5 mile (8 km) intervals. These landscaped areas will contain watering troughs, hitching posts, bicycle racks, picnic tables, and rest rooms. The trail along the

diversion channel will link with several existing and proposed city and county trails, enabling bicyclists to reach almost any portion of the metropolitan area, and equestrians to ride via the 51st Avenue county trail to Thunderbird Park and to the proposed Adobe Dam recreation area. Connecting trails through Cave Creek Regional Park will lead to the Cave Buttes Dam recreation area and to recreation areas planned along Reach 11 of Granite Reef aqueduct.

The unlined trapezoidal portion of the Arizona Canal diversion channel, from Cactus Road to Skunk Creek, will be developed as a recreation parkway; the majority of the facilities will be eligible for cost sharing. The exceptions are mentioned in the text (pl. 14d). Many activity areas are planned in the vicinity of 59th Avenue and Thunderbird Road. Picnic facilities will be located near small lagoons that may be used for casting practice and sailing of model boats while functioning as energy dissipators. A children's play area will be located nearby. A portion of the relocated Arizona Canal is being considered as the site for a potential canoeing and rowing course, to be developed without Federal participation. A multipurpose court-game area--as well a retirement recreation area (local cost) with facilities for shuffleboard, horseshoes, and patio games--also is planned. Athletic fields will accommodate football, baseball, field hockey, and soccer games. Local interests will construct a bicyclists hostel and information building.

Equestrian activities, very popular in the Glendale area, will be provided for in the parkway in the vicinity of 67th Avenue. This area will contain an equestrian training area and an open riding area. A grassy area may be used for horse grooming and exercising, informal riding competition, and for organized activities such as 4-H club meetings.

The westernmost part of the parkway and the confluence of the diversion channel and Skunk Creek will be designated a Natural Resources Appreciation Area. Existing vegetation will be augmented by the planting of selected species. The channel widens at the confluence, and additional vegetation in this area will be useful in slowing down the rate of stormwater flows. Field archery facilities will be located in this area.

Trails for bicyclists, equestrians, hikers, and joggers will continue west from Cactus Road through the parkway. Rest room facilities will be conveniently located throughout the recreation area. Trails and rest room facilities will be cost shared. The local interests are also proposing development of a people mover system.

The landscaping plan for the parkway will be consistent with the hydraulic requirements and will be included as a flood control cost. Low-density planting established on the slopes of the parkway and in selected areas of the channel invert, will provide shade and esthetic variety to the recreation areas.

Refinement of the concepts and uses along the Arizona Canal diversion channel will be presented in Design Memorandum No. 3, Part 5.

H. SKUNK CREEK AND THE NEW AND AGUA FRIA RIVERS. The flowage easements along Skunk Creek and the New and Agua Fria Rivers will be developed into approximately 20 mi (32 km) of hiking and riding trails (pl. 15). A hard dirt trail, indicated by a sign, will provide safe recreation opportunities for hikers, joggers, and equestrians. Three landscaped rest stops and staging areas--with rest rooms, picnic tables, hitching posts, and watering troughs--will be provided in convenient locations along the trails. All proposed development in this area is cost sharable with the Federal Government.

Additional analysis and planning will be addressed in Design Memorandum No. 3, Part 5.

Part of the justification of recreation development depends on the fact that the existing demand within the market area is greater than the supply. All of the New River and Phoenix City Streams projects' unmet demand greatly exceeds the project supply. The figures in table 4 represent the totals for all of the activities proposed at each project.

Columns 1 and 2 display, respectively, the present demand for recreation and the existing supply of recreation. Column 3 reflects the unmet demand for recreation (the difference between columns 1 and 2). Column 4 represents the supply of recreation days to be furnished by the proposed recreation plans.

Supply and demand figures are in recreation days. One recreation day represents one person recreating for all or any part of a 24-hr day.

Table 4. Recreation Day Supply and Demand Totals (Rounded).

Item	Present Demand	Existing Supply	Unmet Demand	Project Supply
Dreamy Draw	20,741,500	13,660,500	7,081,000	155,800
Cave Buttes	38,388,000	9,520,000	28,868,000	616,500
Adobe	111,000,000	45,000,000	66,000,000	1,025,000
Arizona Canal diversion channel	95,350,000	40,650,000	54,700,000	660,583

The individual Master Plans outlined in this report, will present a thorough, comprehensive plan of development concepts and any modifications thereof. FDMS will detail the specific numbers and locations of the facilities. All proposed development will occur within project boundaries, unless otherwise stated within the master plan. The demand for the recreation opportunities recommended within these plans will still exceed the supply in the market area. The local recreation sponsor, while sharing in the development and the implementation of plans with the Corps, will operate and maintain the facilities, when completed.

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Chapter 11

FACILITY LOAD AND OTHER DESIGN CRITERIA

A. GENERAL. Components of the overall recreation development plans for the New River and Phoenix City Streams project have been designed in accordance with Department of the Army ER 1110-2-400, Engineering and Design - Design of Recreation Sites, Areas, and Facilities. Specific design criteria for each of the proposed recreation facilities will be included in their respective Master Plans and PDMs. The following is intended to serve only as a guide for the overall design of facilities. In general, designs are based on accepted recreation standards, the recreation needs of local residents, the desires of the local sponsoring agencies, and environmental elements (such as the existing native desert landscape, existing land uses, or identified limiting factors).

B. UNIFORM DESIGN FEATURES. Although the recreation facilities proposed in this report are localized at individual projects separated by both space and time, some design features are consistent throughout. Design elements that may be generalized for the separate features are discussed in the following paragraphs.

1. Siting. Site restrictions are imposed to insure development is consistent with flood control requirements and visitor safety. Development, unless stated otherwise in an individual master plan, will be contained within the available rights-of-way required for the flood control project. All lands are to be managed by the local recreation sponsor and the Flood Control District of Maricopa County. Siting limitations are based on flood elevation restrictions. Selections for siting facilities should maximize specific environmental and landscape factors, while also considering the recreation potential in the forms of user preference and satisfaction.

2. Architectural Character. The architectural style will attempt to enhance the character of the existing natural environment. Basic construction materials will include, but are not limited to, concrete, decorative stone, wood, and metal. The structures will be designed to be pleasing, functional, vandal resistant, and low maintenance. The colors and design of facilities will blend with and complement the hues and textures of the surrounding landscape.

3. Rest Rooms. Rest rooms will be located above the 100-year flood elevation and will comply with the sanitation criteria set forth in EM 1110-2-400 and by local governing jurisdictions. Requirements for accessibility by the handicapped also will be followed. Where feasible, rest rooms will be located in close association to activity areas. Construction materials will be selected based on their long life, ease of maintenance, and resistance to vandalism. The type of waste disposal chosen will depend on site specific factors, subject to approval by the Maricopa County Health Department or other local health agencies.

4. Recreation Facilities. Although each project has unique landscape character, design, and recreation opportunities, all the projects will be operable during daylight and evening hours. This makes it possible to satisfy recreation needs hinging on climate and use pressures. Proposed recreation opportunities are diverse, with trail development occurring at all features. Trails will conform to standards developed by the Maricopa County Hiking and Riding Trails Committee.

Picnicking areas will be provided for groups and individual family picnicking. Adequate trash disposal, lighting, barbeques, and rest room facilities also will be conveniently located adjacent to picnic areas and camping sites. Facilities will be designed in accordance with ER 1110-2-400.

5. Landscaping. Planting will enhance the natural landscape by emphasizing landforms and native plant communities. Landscaping will be used to define specific feature, circulation, and recreation use areas. In addition to creating a pleasant atmosphere, designs also will be manipulated to lessen the impact of adverse climatic conditions and environmental elements by using plants as buffers, articulators, screens, and shade.

6. Signs. Eight basic types of signs will guide and direct visitors throughout the projects. Identification, information, direction, regulatory, instruction, interpretive, location, and safety types of messages will be conveyed through a uniform system within each project. (Information and guidance signs will conform to the National Park Service uniform sign system). The material, scale, and design of the signs will vary, depending on the use and the expressed needs of the local recreation sponsor. Symbols will be used for uniformity and ease of recognition, while word signs will provide interpretive or other information, where needed. The primary emphasis will be on clarity. An identification sign will be placed at the entrance to each recreation area. Directional signs will be placed along major arteries near the basins to provide visitors with proper access information. Regulatory signs will restrict unauthorized vehicle use onsite. Instructional and safety signs will caution visitors on the potential flood hazards. Locational signs at strategic points will designate use areas. All signs will be constructed of vandal resistant material and will be positioned for high visibility. Signs will be compatible with the esthetic character of the park.

7. Utilities. Because of the relatively rural settings of the project features, utilities needed usually will require the construction of lines into the basins. All such work and utility alignments will comply with city and county standards.

8. Parking and Access Road. Access road will be provided to parking areas within the basins. Parking areas will be designed to comply with ER 1110-2-400, allowing adequate space for handicapped visitors and recreation vehicles.

**Special
Problems**

Chapter 12

SPECIAL PROBLEMS

Special problems or elements of concern in planning, designing, and constructing recreation facilities within the project features require consideration. Some of the problems are identified below.

A. SCHEDULING FACTORS. Preparation of resource use master plans is dependent on necessary engineering information provided in the FDMS for flood control features.

Scheduling of recreation facility construction hinges on availability of local funds from cost sharing sponsors.

B. POSSIBLE CONSTRUCTION CONFLICTS. If construction of recreation facilities is initiated during construction of flood control features, efforts must be made to avoid conflicts that may arise when two contractors are working in the same area. Conflicts may result from sequence of construction and areas planned for multiple uses, such as borrow areas where recreation development is planned.

C. NECESSARY ACQUISITIONS. Before recreation facilities can be constructed at the detention basins and along Skunk Creek and the New and Agua Fria Rivers, the local recreation sponsor must enter into an agreement with the local flood control sponsor authorizing use of the lands for compatible recreation purposes. The sponsors for recreation development will acquire recreation easements or fee title to any lands required for recreation that are not acquired in fee title by the local sponsor for flood control purposes. Every effort will be made to enter into agreements with durations equal to or greater than the economic life of the flood control features. To protect recreation facilities developed on leased lands, a clause that prohibits landowners from altering or destroying landscaping or facilities will be included in the lease agreement.

D. PRESERVATION OF NATURAL HABITAT. Sand and gravel operations at Cave Buttes Dam and Adobe Dam have destroyed natural habitat and scarred the landscape. Should these operations expand to other parts of the reservoirs, more and more of the landscape would be highly disturbed; this, in turn, could affect the location of planned recreation facilities. Extensive landscaping and many years would be required to revitalize and beautify these destroyed areas.

E. BORROW AREAS. The areal extent and depth of the borrow areas will influence recreation development within and adjacent to these areas. Recreation development plans may need to be modified to better accommodate the completed borrow areas.

F. ARCHEOLOGIC CONSIDERATIONS. Master plans for each of the project features must take into consideration the archeologic sensitivity of sites within the project boundaries. Land use planning for each of these areas must be coordinated with archeologic interests in order to either attract visitors to specific sites for educational purposes or discourage certain uses for resource protection.

G. POSSIBLE INUNDATION. Because the recreation facilities in the reservoirs will sustain some damage during periods of flooding and inundation, the final planning and design of recreation facilities in the reservoir will include consideration of the possibility of inundation. The design details will be discussed in forthcoming master plans.

H. SPECIAL POPULATIONS. Many special populations, such as senior citizens and the physically handicapped, locate within the Phoenix metropolitan area because of the warm, dry climate. The planning and design of recreation development associated with the project not only will accommodate, but will encourage, use by these special populations. Specific plans and criteria for design of facilities will be outlined in the individual master plans and detailed in the recreation FDM.

I. NIGHT LIGHTING. Arizona is noted for its hot, dry desert climate. Because temperatures reach into the range of 100° F (37.3° C) during the summer days, but cool off during the nights, maximum recreation use extends from dusk well into the hours after dark. Consequently, provisions will be made for night lighting, both for night recreation use and for a security patrol program.

J. ALTERNATIVE WATER SOURCE. It is planned that water for Cave Creek Regional Park will come from the Granite Reef aqueduct of the Central Arizona Project. The Arizona Water Commission has assured the recreation task force that plans for the Granite Reef aqueduct are materializing as scheduled, and there is virtually no need for concern that the project will not be completed. Despite such assurance, however, a great deal of controversy surrounds the Central Arizona Project. If Granite Reef aqueduct is not constructed, water for Cave Creek Regional Park could be obtained by drilling additional wells in the wash area.

K. ALINEMENT PLANS. Urban development has penetrated many areas adjacent to the Arizona Canal. The proposed alinement of the diversion channel passes through two city parks, the Sunnyslope High School and Arroyo Elementary School athletic fields, the Arizona Biltmore Estate, some businesses, and many private homes. As plans for the alinement of the channel become refined, new recreation resources might be identified. Also, adjustment will be made of the plans proposed in the Master Plan for the Arizona Canal diversion channel to take advantage of any new opportunities that become available.

D. EXISTING RECREATION FACILITIES. Plans for recreation development have been coordinated with existing and proposed recreation facilities within the project area. Along the Arizona Canal, and unavoidable but easily resolved conflict in plans occurs. In 1976, the City of Phoenix, with funds granted from the U.S. Bureau of Outdoor Recreation (now Heritage Conservation and Recreation Service), constructed a 6-mi (10-km) bicycle path along the northern 10 ft (3 m) of the Arizona Canal right-of-way. This bikeway is heavily used by bicyclists and joggers. Although construction of the Arizona Canal diversion channel will destroy the bike path, a paved maintenance road will be provided along the northern side of the diversion channel as part of the flood control costs. This maintenance road also will serve as a replacement trail for the bicyclists and joggers.

**Resource
Management**

Chapter 13

PROJECT RESOURCE MANAGEMENT

A. GENERAL. The operation and management of all recreation facilities constructed under the project authority cited in the introduction will be the responsibility of local interests. Maricopa County Parks and Recreation Department has submitted to the Corps of Engineers a resolution from the Maricopa County Parks and Recreation Commission and supportive letters expressing interest in serving as the overall sponsor for recreation development along the channels and flowage easements and at the Cave Buttes and Adobe detention basins.

The City of Phoenix has reviewed and approved the draft cost sharing agreement for recreation development at Dreamy Draw Dam detention basin and provided a letter of intent to act as the local sponsor within the basin. The Arizona Game and Fish Department has expressed their interest in managing the wildlife habitat area at New River Dam. The county has received resolutions from the Cities of Phoenix, Glendale, Peoria, and Avondale supporting development of the trail system as it will pass through their respective municipalities. The Maricopa County Parks and Recreation Department also has submitted a letter of approval of the draft cost sharing agreement for the overall project and an updated letter of intent for the first two features, Cave Buttes Dam and Adobe Dam, where they wish to cost share in recreation development. The letter of intent, letter of approval of the draft cost sharing agreement, and the draft cost sharing agreement for the overall project are included as appendixes 1, 2, and 3 of this report.

With assistance from the Corps of Engineers, the project resource managers (the City of Phoenix at Dreamy Draw Dam and Maricopa County at the other project features) will prepare a resource management plan for each of the project features. The plans will be prepared in accordance with, and with guidance from, ER 1130-2-400 and ER 1165-2-400. The plans will be developed within 1 year after completion of the initial recreation construction contract for each of the project areas. When completed, each resource management plan will be included as an appendix to the respective master plan.

B. MANAGEMENT OBJECTIVES. The natural and man-made resources of the New River and Phoenix City Streams project will be managed for the enjoyment of the public, consistent with their carrying capacity and their esthetic, archeologic, and ecologic values. This policy will be achieved by compliance with the following objectives.

- Protect project visitors and employees.
- Improve and protect project resources; enforce zoning requirements to avoid conflict between recreation uses and archeologic and ecologic preservation.
- Prevent unauthorized visual and physical encroachments and structures, trespassing, and any other misuse of project lands and waters.
- Insure compatibility between recreation uses and equipment employed in the recreation activity.
- Improve the project environment by landscape treatment, such as plantings and control of noxious weeds.
- Encourage local officials to adopt and enforce zoning and building codes to control private developments adjacent to the project and thus avoid problems of water pollution, visual pollution or the use of project roads for access to private property.

C. **OPERATIONAL CONCEPTS AND POLICIES.** In accordance with the recreation cost sharing agreements, operation, maintenance, and replacement of recreation facilities will be the responsibilities of the local recreation sponsors. Decisions regarding the types of facilities planned in the project area have been closely coordinated with local interests. In meeting the needs of the people within the recreation market area, project land development emphasizes primarily day use activities and, secondarily, night use activities. Operation and maintenance of the facilities, a local responsibility, should be similar to that of like facilities in the area that are operated and maintained by the local sponsors. Policies regarding the operation and maintenance of the recreation resources will be established by the local sponsors with full regard for the primary project purpose of flood control.

Uses compatible with the character of the project areas and adjacent lands will be established and encouraged, with protection and enhancement of environmental quality a prime objective of the local sponsoring agencies.

D. **ADMINISTRATION.** Administrative duties for the recreation facilities will rest on the local recreation sponsors for each of the project features.

E. **STAFFING AND ORGANIZATION.** The management of the New River and Phoenix City Streams project recreation areas will be the responsibility of the local recreation sponsors. Management will include scheduling of events and reservation of specific use areas. If the need develops for an onsite park ranger, this person will be furnished by the local recreation sponsor.

F. LAW ENFORCEMENT. Law enforcement in the project areas will be the responsibility of the local enforcement agency of the recreation sponsors. The project areas will be patrolled regularly by local police and possibly by park rangers. Security lighting will be provided for night patrols. Public telephones, strategically located in or near the recreation areas, will assist visitors in cases of emergencies.

G. SAFETY. Signs, markers, and physical barriers will be provided throughout the entire project areas. These will control pedestrian, equestrian, and vehicular traffic; also, they will warn the public of potentially hazardous conditions, if a flood should occur. The local recreation agencies will be responsible for insuring the safe and proper use of the project areas, including the project lands, recreation facilities, and other features.

H. CONCESSION ACTIVITIES. No permanent concessionaire activities are proposed at this time. However, such activities that might exist after completion of the project must comply with the previously mentioned management objectives and must be in accordance with the contract agreements of the local recreation sponsor.

I. VISITOR INTERPRETATION AND EDUCATION. An effective interpretive program informs and educates the public with regard to the purpose and operation of the project and the natural, historic, and archeologic features unique to the area. Interpretive services within the project areas will be implemented as part of the cultural resources interpretive program and the phased recreation development.

**Comparisons
of Cost**

Chapter 14

DEPARTURE FROM PREVIOUSLY APPROVED PLANS: COMPARISON OF COSTS

A. GENERAL. The estimated first costs for recreation development at each of the New River and Phoenix City Streams project features include the costs arrived at from review of the Phase I, GDM PB-3 1980, and present (October 1980) estimates. The figures represent the total expected recreation development costs, including the non-Federal contributions. The purpose of this section is to account for modifications in the Phase I estimated costs, as compared with the PB-3 and present estimates.

B. COMPARISON OF PHASE I ESTIMATES WITH PB-3 ESTIMATES. The Phase I estimates, completed in October 1975 and presented in the New River and Phoenix City Streams General Design Memorandum - Plan Formulation (GDM), were subsequently reviewed and modified. These preliminary calculations were designed to assess costs for Federal and non-Federal entities cost sharing in recreation development at each of the features. In a review, modifications of these estimates were made to reflect the proper distribution of costs between cost sharable and non-cost sharable items. The Phase I figures reflect preparatory recreation planning efforts.

The PB-3 figures demonstrate the application of price leveling and an expanded recreation plan from the original Phase I cost estimates for the project.

C. COMPARISON OF PRESENT ESTIMATES WITH PB-3 ESTIMATES. Any changes in the present (October 1980) estimated first costs, as compared with the PB-3 estimates shown on table 5, are the result of expanded and more detailed costs, planning, and design analysis for the proposed recreation developments. This is due to price leveling, a more detailed design analysis, increased local participation, and changes in the facilities the Corps of Engineers is authorized to construct.

1. Dreamy Draw Dam. An increase of \$549,000 is due to an expanded recreation plan and a more detailed cost estimate.

2. Cave Buttes Dam. An increase of \$3,985,000 is a result of more detailed engineering and design studies, and supervision and administration costs. Also, a more detailed recreation plan and project cost estimate contributed to the increase.

3. Adobe Dam. An increase of \$610,000 is due to an expanded recreation plan, a more detailed cost estimate for the proposed facilities, and increased engineering and design costs.

4. Master Plans. The PB-3 estimate reflects only the cost for the Overall Master Plan, DM No. 4. The present estimate includes the costs for each of the master plans to be prepared for the New River and Phoenix City Streams project. These costs previously have been included in the engineering and design, and supervision and administration costs for each of the projects.

5. Cave Creek Regional Park. A Corps policy has not been formulated on the eligibility of nonstructural flood control for recreation development. Consequently, Cave Creek Regional Park cost estimates have been deleted until a firm policy is established.

6. Other features not addressed in the above paragraphs show no change from the PB-3 estimates to the present estimates.

Table 5 shows a comparison of estimated first costs at each of the features.

Table 5. Comparison of First-Costs.

Cost Acct. No.	Recreation Item	Recommended Plans ¹		
		Phase I Oct. 1975	PB-3 Oct. 1980	Present Oct. 1980
14	Dreamy Draw Dam	334,000	514,000	1,063,000
30	E and D	33,000	162,000	162,000
31	S and A	<u>33,000</u>	<u>80,000</u>	<u>80,000</u>
	TOTAL	<u>400,000</u>	<u>756,000</u>	<u>1,305,000</u>
14	Cave Buttes Dam	448,000	688,000	4,305,000
30	E and D	46,000	308,000	557,000
	S and A	<u>46,000</u>	<u>104,000</u>	<u>223,000</u>
	TOTAL	<u>540,000</u>	<u>1,100,000</u>	<u>5,085,000</u>
14	Adobe Dam	2,700,000	4,580,000	4,943,000
30	E and D	275,000	394,000	652,000
31	S and A	<u>275,000</u>	<u>446,000</u>	<u>218,000</u>
	TOTAL	<u>3,250,000</u>	<u>5,420,000</u>	<u>5,813,000</u>
14	New River Dam	-0-	-0-	-0-
30	E and D	-0-	58,000	-0-
31	S and A	<u>-0-</u>	<u>12,000</u>	<u>-0-</u>
	TOTAL	<u>-0-</u>	<u>70,000</u>	<u>-0-</u>
14	ACDC (Dreamy Draw to Cactus Road) ²	1,449	2,488	2,488
30	E and D	148	241	241
31	S and A	<u>147</u>	<u>240</u>	<u>240</u>
	TOTAL	<u>1,744</u>	<u>2,969</u>	<u>2,969</u>

1 Includes non-Federal contributions.

2 Includes Cave Creek channel Peoria Ave. to the Arizona Canal diversion channel

3 Master Plan preparation costs in Phase I and PB-3 1980 estimates were not broken out separately, but included in the E and D and the S and A costs for each of the projects. Present estimate includes the actual amount spent as of 31 July 1980 and the projected amount to be spent in the completion of the Master Plans.

Table 5. (Continued)

Cost Acct. No.	Recreation Item	Recommended Plans ¹		
		Phase I Oct. 1975	PB-3 Oct. 1980	Present Oct. 1980
14	ACDC (Cactus Road to Skunk Creek)	2,100,000	3,485,000	3,900,000
30	E and D	215,000	322,000	390,000
31	S and A	215,000	322,000	390,000
	TOTAL	<u>2,530,000</u>	<u>4,129,000</u>	<u>4,680,000</u>
14	Flowage Easements (Skunk Creek, New and Agua Fria Rivers)	288,000	443,000	433,000
30	E and D	29,000	42,000	42,000
31	S and A	29,000	42,000	42,000
	TOTAL	<u>346,000</u>	<u>527,000</u>	<u>527,000</u>
14	Master Plans ³	---	---	---
30	E and D	85,000	29,000	340,000
31	S and A	15,000	6,000	75,000
	TOTAL	<u>100,000</u>	<u>35,000</u>	<u>415,000</u>
14	Cave Creek Region Park	7,165,000	-0-	-0-
30	E and D	718,000	-0-	-0-
31	S and A	717,000	-0-	-0-
	TOTAL	<u>8,600,000</u>	<u>-0-</u>	<u>-0-</u>

1 Includes non-Federal contributions.

2 Includes Cave Creek channel Peoria Ave. to the Arizona Canal diversion channel

3 Master Plan preparation costs in Phase I and PB-3 1980 estimates were not broken out separately but included in the E and D and the S and A costs for each of the projects. Present estimate includes the actual amount spent as of 31 July 1980 and the projected amount to be spent in the completion of the Master Plans.

Cost Apportionment

Chapter 15

COST APPORTIONMENT

The apportionment of first costs between Federal and non-Federal interests is described below.

Table 6 presents a summary of the first cost for recreation at present price levels. Items that are entirely Federal costs are shown in column 1 with an explanation in the following paragraph. The cost sharable Federal and non-Federal totals are given in column 2 for each of the features, while column 3 shows costs to be borne totally by non-Federal interests. The final column supplies the total cost for recreation facilities development at each of the features.

The Federal cost at Dreamy Draw Dam is for the esthetic treatment of the spillway, which will be completed as a separate line item with construction of recreation facilities.

The Federal cost at Cave Buttes Dam is for the widening of Jomax Road for safety reasons.

Phase I Design Memorandum total reflects the cost borne by the Federal Government in the preparation of a recreation appendix for the basic flood control document.

Preparation of recreation Master Plan for each of the projects is borne by the Federal Government.

Table 7 shows the cost apportionment between Federal and non-Federal interests for the entire project. The Federal total consists of the total for non-apportionable planning (Federal column table 6) added to the total construction cost (Federal/non-Federal column table 6) minus the non-Federal portion of the construction cost (half of the Federal/non-Federal column). This total reflects the Federal Government's contribution to the project.

The non-federal column consists of the total cost of lands (non-Federal column lands subtotal table 6), half of the construction cost (half of the Federal/non-Federal column table 6), and the total for non-apportionable construction (the non-Federal column subtotal before lands, table 6). This total, when added to the total Federal contribution, yields the total project recreation cost.

Table 6. Summary of First-Costs for Recreation:
Amounts (in thousands of dollars)
at October 1980 Price Levels.

Item	Federal	Federal and Non-Federal	Non-Federal ¹	Total
FACILITIES				
Dreamy Draw Dam	16.5	1,288.5	Ø	1,305
Cave Buttes Dam	Ø	4,492	593	5,085
Adobe Dam	Ø	5,217	596	5,813
New River Dam	Ø	Ø	Ø	Ø
Arizona Canal Diversion Channel	Ø	7,360	289	7,649
Dreamy Draw to Cactus Rd. ²	Ø	(2,969)	(Ø)	
Cactus Rd. to Skunk Creek	Ø	(4,391)	(289)	
Skunk Creek, New & Agua Fria Rivers	Ø	527		527
SUBTOTAL	<u>16.5</u>	<u>18,191.5</u>	<u>1,478</u>	<u>19,686</u>
REPORTS				
Phase I Design Memorandum	570	Ø	Ø	570
Recreation Master Plans	415	Ø	Ø	415
Feature Design Memoranda and Plans & Specifications	Ø	1,090	Ø	1,090
SUBTOTAL	<u>985</u>	<u>1,090</u>	<u>Ø</u>	<u>2,075</u>

¹ Non-Federal costs shown are those for facilities included in the Phase I GDM that were determined ineligible for Federal cost sharing.

² Includes Cave Creek (Peoria Ave. to Arizona Canal).

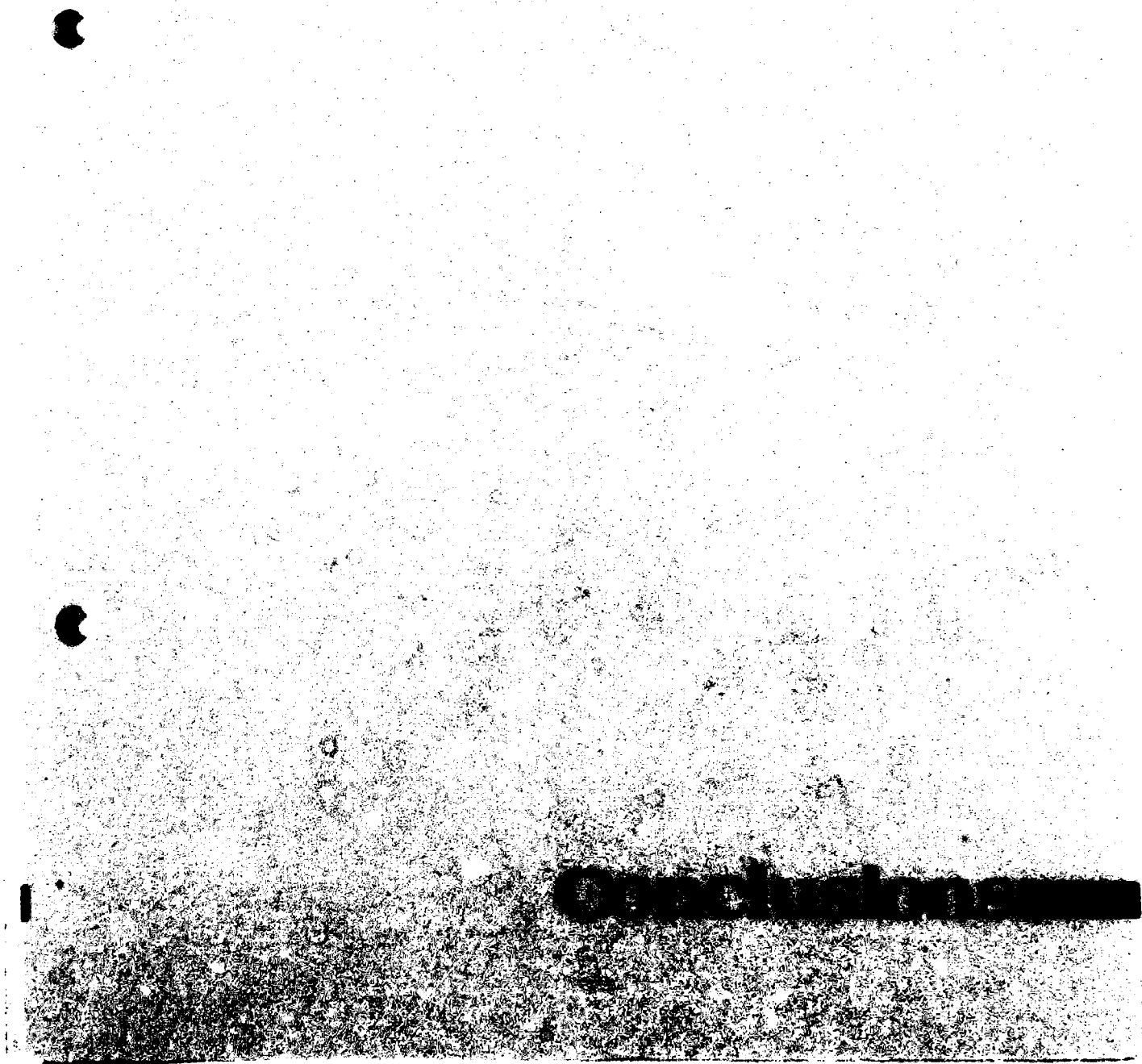
³ Local flood control projects require that the non-Federal entity acquire in its name, and dedicate to public outdoor recreation use for the economic life of the basic flood control improvements, all lands required for recreation development and needed to insure public control of the development.

Table 6 (Continued)

Item	Federal	Federal and Non-Federal	Non-Federal ¹	Total
LANDS (Flowage Easements) ³				
Arizona Canal Diversion Channel	Ø	Ø	29	29
Skunk Creek, New & Agua Fria Rivers	Ø	Ø	9	9
SUBTOTAL	<u>Ø</u>	<u>Ø</u>	<u>38</u>	<u>38</u>
TOTAL, Facilities, Reports & Lands	<u>1,001.5</u>	<u>19,281.5</u>	<u>1,516</u>	<u>21,799</u>
¹ Non-Federal costs shown are those for facilities included in the Phase I GDM that were determined ineligible for Federal cost sharing. ² Includes Cave Creek (Peoria Ave. to Arizona Canal). ³ Local flood control projects require that the non-Federal entity acquire in its name, and dedicate to public outdoor recreation use for the economic life of the basic flood control improvements, all lands required for recreation development and needed to insure public control of the development.				

Table 7. Cost Apportionment--Entire Project.

Item	Dollars (rounded)
Federal	
Non-apportionable planning	1,001,500
Construction	19,281,500
Cash contribution	<u>-9,640,750</u>
Total	10,642,250
Non-Federal	
Lands and relocations	38,000
Cash contribution	9,640,750
Non-apportionable construction	<u>1,478,000</u>
Total	<u>11,156,750</u>
TOTAL PROJECT	<u>21,799,000</u>



Chapter 16

CONCLUSIONS

This report discusses the comprehensive conceptual development recommended for the New River and Phoenix City Streams project. From the information presented herein, the following points are the general conclusions.

- a. While the specific features of the New River and Phoenix City Streams project are viewed as a comprehensive system for flood control and recreation, there is a need for individual master plans for each of the project features because of the multiplicity of local sponsors, complexity of each feature area, and variance in the scheduling of engineering information needed for completion of land use planning for each of the project features.
- b. The development of conceptual plans for the entire project area has been accomplished with the assistance of and extensive coordination with a recreation task force composed of representatives of agencies, organizations, and groups most knowledgeable of and active in recreation planning within the market area. Such coordination has resulted in an overall plan for recreation development of the market area, plus other existing and proposed recreation resources and facilities contained therein. The recommended plan for the project recreation areas utilizes the framework of a comprehensive system of recreation areas to insure a diversity of facilities while avoiding an overabundance of any particular type of facility.
- c. The plan optimizes the use of land for flood control, open space, and recreation development. The primary purpose of flood control will be maintained and the secondary purposes of recreation and open space will be provided.
- d. Hydrologic and hydraulic considerations have been utilized in planning activities and their locations within the project boundaries, including access and egress routes, to insure the safety of the users.
- e. Recreation opportunities and improvements planned are in concert with the needs identified in the SCORP.
- f. Construction of the overall development plan will enhance recreation opportunities in Maricopa County.

- g. Development of the plan will help meet the demands for certain types of day and night use activities. Although the plan will not fulfill the market area's total recreation demand, it will significantly increase opportunities for many types of activities.
- h. Existing and projected rapid urban growth in the Phoenix metropolitan area makes the project areas valuable for recreation and open space.
- i. Implementation of the plan will preserve and enhance environmental and scenic qualities of the project areas.
- j. Development of the project features will comply with and complement the development projected for the Phoenix metropolitan area.
- k. Trails planned within the project area will be integrated with local trail systems.
- l. The development plans optimize the use of available project lands with respect to costs and future demands.
- m. The development plans have strong local support from officials, departments, and user groups.
- n. The local recreation sponsors will operate and maintain the facilities and manage the resources in continuity with management policies of other recreation areas.

C

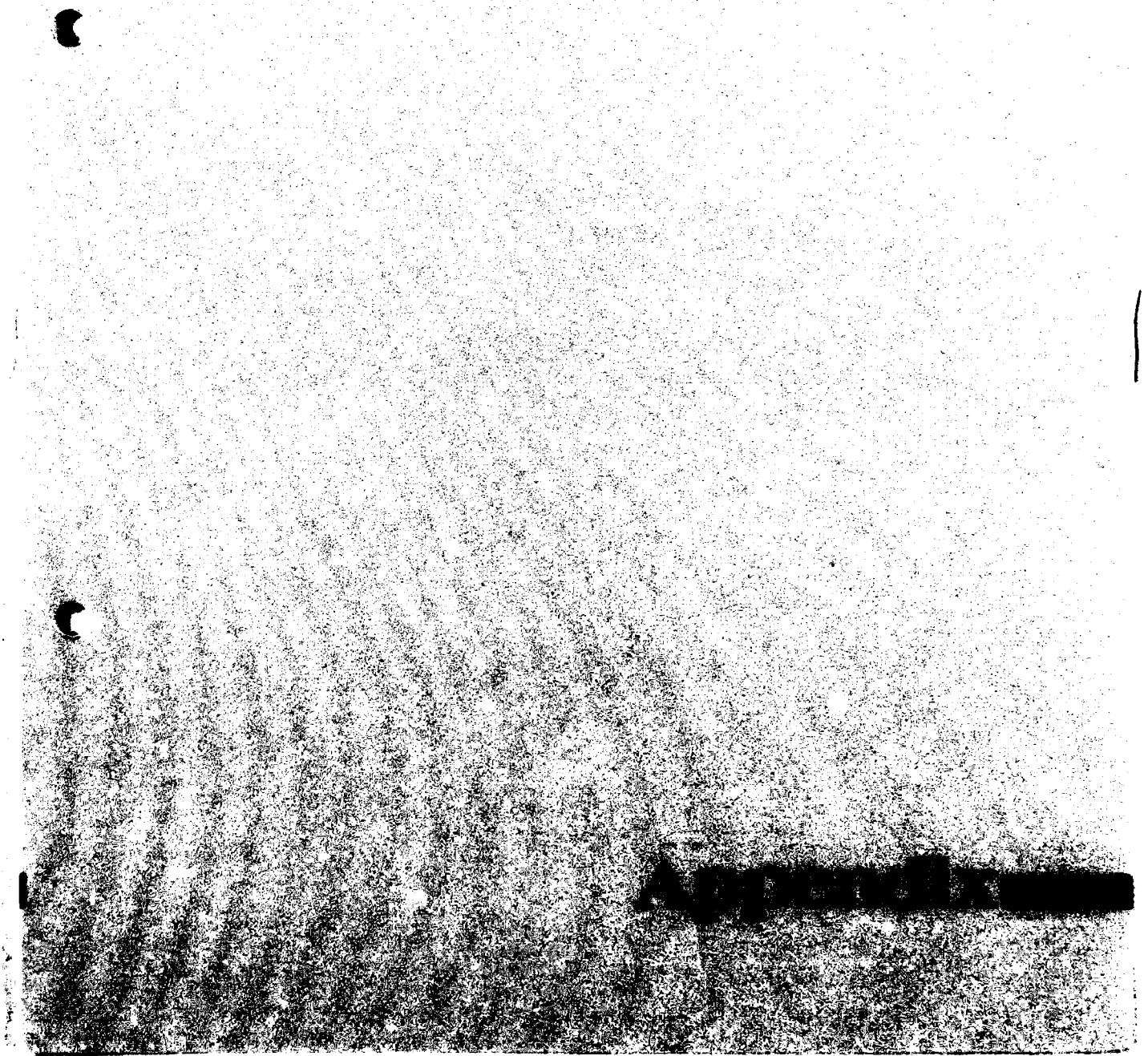
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Recommendations

Chapter 17

RECOMMENDATIONS

It is recommended the recreation plan presented in this report be approved to serve as a general guide for future planning, design, development and management of the New River and Phoenix City Streams project lands.



APPENDIX 1

OFFICE OF THE BOARD OF SUPERVISORS

MARICOPA COUNTY

602 County Administration Bldg 111 S. 3rd Avenue, Phoenix, Arizona 85003

TOM FREESTONE
District 1

GEORGE L. CAMPBELL
District 2

FRED KOORY JR.
District 3

HAWLEY ATKINSON
District 4

ED PASTOR
District 5



March 14, 1974

Colonel William A. Tupper
District Engineer/Executive Office
U.S. Army Corps of Engineers
1111 North Central Avenue
Phoenix, Arizona 85004

Dear Colonel Tupper:

At the last Board meeting of March 14, 1974, the Maricopa County Board of Supervisors reaffirmed the County's interest in recreational development of the Cave Buttes Dam and the Aldean floodplain area, and requested that the local sponsoring agency,

advise us.

Hawley Atkinson
Hawley Atkinson
Chairman

Atty:

cc: Mrs. Ruth Bajza Chase, Geographer
U.S. Army Corps of Engineers
1111 North Central Avenue, Suite 100
Phoenix, Arizona 85004

Mr. Robert H. Milne, Director
Maricopa County Parks & Recreation Dept.
4701 East Washington Street
Phoenix, Arizona 85034

APPENDIX 2

MARICOPA COUNTY PARKS AND RECREATION DEPARTMENT

4701 EAST WASHINGTON STREET, PHOENIX, ARIZONA 85034

ADMINISTRATION & PARKS 262-3711

RECREATION 262-3716



July 28, 1975

Colonel John V. Foley, District Engineer
Department of the Army
Los Angeles District, Corps of Engineers
P.O. Box 2711
Los Angeles, CA 90053

Dear Colonel Foley:

Thank you for the opportunity to review your proposed cost sharing contract for the recreation development in association with the New River and Phoenix City Streams Flood Control Project. I submitted the draft to our County Legal Department for analysis and would like to state that Maricopa County does agree with the concept as outlined in the contract.

Sincerely,

R.H. Milne

Robert H. Milne

M:m

cc: Major Terry Kirkpatrick

PARKS AND RECREATION COMMISSION

CLARE PELSTED + CHAIRMAN

SUSAN COMILL + VICE CHAIRMAN

BOCKHE ARNETT + SECRETARY

MIRE AUGUSTINE

RAY BLASDELL

HERB CAYWOOD

DALE K. DOWNEY

FRED M. GIVREY

ROBERT H. MILNE + DIRECTOR

DONALD R. GLEN

CHESTER OLSEN

A. Y. FREDERLEY

APPENDIX 3

CONTRACT BETWEEN
THE UNITED STATES OF AMERICA
AND
MARICOPA COUNTY
FOR
RECREATION DEVELOPMENT
AT THE
NEW RIVER AND PHOENIX CITY STREAMS FLOOD CONTROL PROJECT
GILA RIVER BASIN, ARIZONA

THIS CONTRACT entered into this ___ day of _____, 19__ by and between the UNITED STATES OF AMERICA (hereinafter called the "Government"), represented by the Contracting Officer executing this contract and the County of Maricopa (hereinafter called "County"),

WITNESSETH THAT:

WHEREAS, construction of the Gila River Basin, New River and Phoenix City Streams Flood Control Project (hereinafter called the "Project") was authorized by the Flood Control Act approved 27 October 1965 (Public Law 89-298, 89th Congress); and

WHEREAS, said Project was subsequently modified by Design Memorandum No. 3 (General Design Memorandum-Phase I) approved by the Chief of Engineers ; and

WHEREAS, it is the goal of Maricopa County to realize the fulfillment of the nationally recognized Sun Circle Trail and to develop recreational facilities along its route and on adjacent spur trails to it; and

WHEREAS, the Recreation Project coincides with a portion of the Sun Circle Trail system, and

WHEREAS, the County is authorized by A.R.S. Sec 41-511.04 and Sec. 41-511.05 to administer Project land areas for recreational purposes and operate, maintain, and replace facilities provided for such purposes and is empowered to contract for such purposes, and is empowered to contract in these respects; and

WHEREAS, pursuant to Section 4 of the 1944 Flood Control Act, as amended by Section 207 of the 1962 Flood Control Act, as amended (16 U.S.C. 460d), the Government is authorized to make contracts with non-Federal public bodies for development, management, and administration of the recreation resources of Federal water resources projects; and

WHEREAS, the Office of the Chief of Engineers has established certain policy for recreation development at Federal non-reservoir water resources projects consistent with Congressional intent as expressed in the Federal Water Resource Project Recreation Act of 1965 (Public Law 89-72).

NOW, THEREFORE, the parties agree as follows:

ARTICLE 1 - DEFINITION OF TERMS. For the purpose of this contract certain terms are defined as follows:

(a) First Costs, used interchangeably with the terms "capital costs" and "project costs," are the initial capital costs of the recreation features of the project, including: engineering, design, supervision, and administration; land acquisition and construction.

(b) Recreation lands: Project lands acquired primarily for recreational purposes, excluding lands needed for flood control or other project purposes.

(c) Recreation facilities: Those facilities for recreation which may be installed pursuant to this agreement.

ARTICLE 2 - LANDS AND FACILITIES.

(a) The County is required to provide all recreation lands.

(b) The Government agrees to design and construct the Project to provide for optimum enhancement of general recreation consistent with other authorized Flood Control Project purposes. Details on lands and facilities necessary for such enhancement are shown in Gila River Basin, New River and Phoenix City Streams, Arizona; Design Memorandum No. 3, General Design Memorandum-Phase I as concurred in by the County and incorporated herein by reference.

(c) The Government in cooperation with the County will prepare a mutually acceptable Recreation Master Plan which will depict and identify the types and quantities of facilities which the Government and the County will construct in accordance with this contract. The presently estimated cost of facilities to be provided is contained in Exhibit A entitled "Estimated Recreation First Cost" attached hereto and made a part hereof. Such estimate of facility cost is subject to reasonable adjustment as appropriate upon completion of construction and approval of the above mentioned Recreation Master Plan.

(d) The facilities as shown in Exhibit A, as it may be adjusted in accordance with paragraph (c) above, shall be constructed jointly by the parties through mutually satisfactory division of responsibility for construction which takes into account direct and indirect cost savings which may be gained by the parties in the public interest for certain specific facilities, provided, that the facilities to be constructed by each party shall be formally agreed upon by the two parties prior to construction, consistent with the provisions of Article 3.

(e) Title to all lands and facilities specifically acquired, developed, or constructed by or with Government assistance to enhance the recreation potential of the project shall at all times be in public ownership.

(f) The performance of any obligation or the expenditure of any funds by the Government under this contract is contingent upon Congress making the necessary appropriations and funds being allocated and made available for the work required hereunder.

ARTICLE 3 - CONSIDERATION AND PAYMENT. Each party hereto will pay or contribute in kind fifty percent (50%) of the first costs of recreation development and fifty percent (50%) of the costs of future development.

(a) Initial Development. Fifty percent (50%) of the estimated first costs of initial recreation development is estimated to be \$_____. Prior to the advertisement of the first construction contract hereunder and again prior to the advertisement of each subsequent construction contract thereafter, the Government Contracting Officer shall calculate the estimated expenditures which each party shall have made through the end of such contract. If the total estimated expenditures by the Government shall exceed those of the County, the County shall pay to the Government such sum as will equalize the expenditures of both parties, prior to award of such contract. In computing expenditures, there shall be considered, in addition to cash expenditures, contributions in kind such as land or facilities, at the fair market value thereof at the time such land and facilities are provided, which value shall not include enhancement due to the project. Upon completion of initial recreation development,

an adjustment will be made on the basis of actual costs incurred. It is understood and agreed that the county's share of the cost of the construction shall be computed on the basis of actual costs to the Government of the work included in the Government construction contract above and on the basis of unit prices in the Government contract and final quantities covering labor, materials, and equipment required for the work under the Government construction contract plus the amount of twenty percent (20%) to cover Government's costs for engineering, design, supervision and administration and not on the basis of prior estimates.

(b) Future Development. Neither party is obligated by this contract to undertake any future development of the Project, except to the extent this contract may be so modified by future supplemental agreement signed by the parties and approved by the Secretary of the Army or his authorized representative. If at any time the County wishes to undertake further development of the facilities hereunder, it may do so at its expense provided prior approval of the Contracting Officer is obtained, but the Government shall not be obligated to reimburse the County for any portion of such expense in the absence of a supplemental agreement hereto as aforesaid.

(c) Other Federal Funds. No repayment credit of any kind whatsoever will be allowed the County for expenditures financed by, involving, or consisting of, either in whole or in part, contributions or grants of assistance received from any Federal agency in providing any lands or facilities for recreation enhancement hereunder.

(d) Adjustments to Reflect Costs. The dollar amounts set forth in this Article are based upon the Government's best estimates, and are subject to adjustments based on the costs actually incurred. Such estimates are not to be construed as representations of the total financial responsibilities of each of the parties.

ARTICLE 4 - CONSTRUCTION AND OPERATION OF ADDITIONAL FACILITIES. Certain types of facilities including but not necessarily limited to restaurants, lodges, golf courses, cabins, clubhouses, overnight or vacation-type structures, stables, marinas, swimming pools, commissaries, chairlifts, and such similar revenue-producing facilities may be constructed by the County or third parties and may be operated by the County or by third parties on a concession basis. Any such construction and operation of these types of facilities shall be compatible with all project purposes and shall be subject to the prior approval of the Contracting Officer. However, the County shall not receive credit for costs of such facilities against amounts due and payable under Article 3.

ARTICLE 5 - FEES AND CHARGES. The County may assess and collect fees for entrance to developed recreation areas and for use of the project facilities and areas, in accordance with a fee schedule mutually agreed to by the parties. Not less often than every five (5) years, the parties will review such schedule and upon the request of either, renegotiate the schedule. The renegotiated fee schedule shall, upon written agreement thereto by the parties, supersede prior schedules without the necessity of modifying this contractual document.

ARTICLE 6 - FEDERAL AND STATE LAWS.

(a) In acting under its rights and obligations hereunder, the County agrees to comply with all applicable Federal and State laws and regulations, including but not limited to the provisions of the Davis-Bacon Act (40 U.S.C. 276 a-a(7)); the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333); and part 3 of Title 29, Code of Federal Regulations.

(b) The County furnishes its assurance that it will comply with Title VI of the Civil Rights Act of 1964 (78 Stat. 241, 42 U.S.C. 2000d, et seq) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations. The County agrees also that it will obtain such assurances from all its concessionaires.

(c) The County furnishes its assurance that it will comply with Sections 210 and 305 of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646).

ARTICLE 7 - OPERATION AND MAINTENANCE. The County shall be responsible for operation, maintenance, and replacement without cost to the Government, of all facilities developed to support Project recreation opportunities. The County shall maintain all Recreation Project lands, waters and facilities in a manner satisfactory to the Contracting Officer.

ARTICLE 8 - RELEASE OF CLAIMS. The Government and its officers and employees shall not be liable in any manner to the County for or on account of damage caused by the development, operation, and maintenance of the recreation facilities of the Project. The County hereby releases the

Government and agrees to hold it free and harmless and to indemnify it from all damages, claims, or demands that may result from development, operation, and maintenance of the recreation areas and facilities.

ARTICLE 9 - TRANSFER OR ASSIGNMENT. The County shall not transfer or assign this contract nor any rights acquired thereunder, nor grant any interest, privilege or license whatsoever in connection with this contract without prior approval of the Secretary of the Army or his authorized representative except as provided in Article 4 of this contract.

ARTICLE 10 - DEFAULT. In the event the County fails to meet any of its obligations under this agreement, the Government may terminate the whole or any part of this contract. The rights and remedies of the Government provided in this Article shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

ARTICLE 11 - EXAMINATION OF RECORDS. The Government and the County shall maintain books, records, documents, and other evidence pertaining to costs and expenses incurred under this contract, to the extent and in such detail as will properly reflect all net costs, direct and indirect, of labor, materials, equipment, supplies, and services, and other costs and expenses of whatever nature involved therein. The Government and County shall make available at their offices at reasonable times, the accounting records for inspection and audit by an authorized representative of the parties to this contract during the period this contract is in effect.

ARTICLE 12 - RELATIONSHIP OF PARTIES. The parties to this contract act in an independent capacity in the performance of their respective

functions under this contract and neither party is to be considered the officer, agent, or employee of the other.

ARTICLE 13 - INSPECTION. The Government shall at all times have the right to make inspections concerning the operation and maintenance of the lands and facilities to be provided hereunder.

ARTICLE 14 - OFFICIALS NOT TO BENEFIT. No member of or delegate to the Congress, or Resident Commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefits.

ARTICLE 15 - COVENANT AGAINST CONTINGENT FEES. The County warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the County for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or in its discretion to add to the contract price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE 16 - ENVIRONMENTAL QUALITY.

(a) In furtherance of the purpose and policy of the National Environmental Policy Act of 1969 (Public Law 91-190, 42 U.S.C. 4321, 4331-4335) and Executive Order 11514, entitled "Protection and Enhancement of Environmental Quality," March 5, 1970 (35 Federal Register 4247, Mar. 7, 1970) the Government and the County recognize the importance of preservation

and enhancement of the quality of the environment and the elimination of environmental pollution. Actions by either party will be after considerations of all possible effects upon the Project environmental resources and will incorporate adequate and appropriate measures to insure that the quality of the environment will not be degraded or unfavorably altered.

(b) During construction and operation undertaken by either party, specific actions will be taken to control environmental pollution which could result from their activities and to comply with applicable Federal, State and local regulations concerning environmental pollution. Particular attention should be given to (1) reduction of air pollution by control of burning, minimization of dust, containment of chemical vapors, and control of engine exhaust gases and smoke from temporary heaters; (2) reduction of water pollution by control of sanitary facilities, storage of fuels and other contaminants, and control of turbidity and siltation from erosion; (3) minimization of noise levels; (4) on- and offsite disposal of waste and spoil activities; and (5) prevention of landscape defacement and damage.

ARTICLE 17 - VALUE OF LANDS AND FACILITIES. If the parties hereto cannot agree on the fair market value of any lands or facilities and cannot otherwise resolve such differences, each party shall name an appraiser and the two appraisers so named shall name a third appraiser, and the decision of at least two of such three appraisers as to the fair market value shall be final and conclusive upon both parties.

ARTICLE 18 - EFFECTIVE DATE. This contract shall take effect upon approval by the Secretary of the Army or his authorized representative.

IN WITNESS WHEREOF, the parties hereto have executed this contract
as of the day and year first above written.

THE UNITED STATES OF AMERICA

THE COUNTY OF MARICOPA

By _____
Colonel, Corps of Engineers
District Engineer
Contracting Officer

By _____
(Title)

DATE _____

ATTEST:

APPROVED:

(Title)

DATE _____

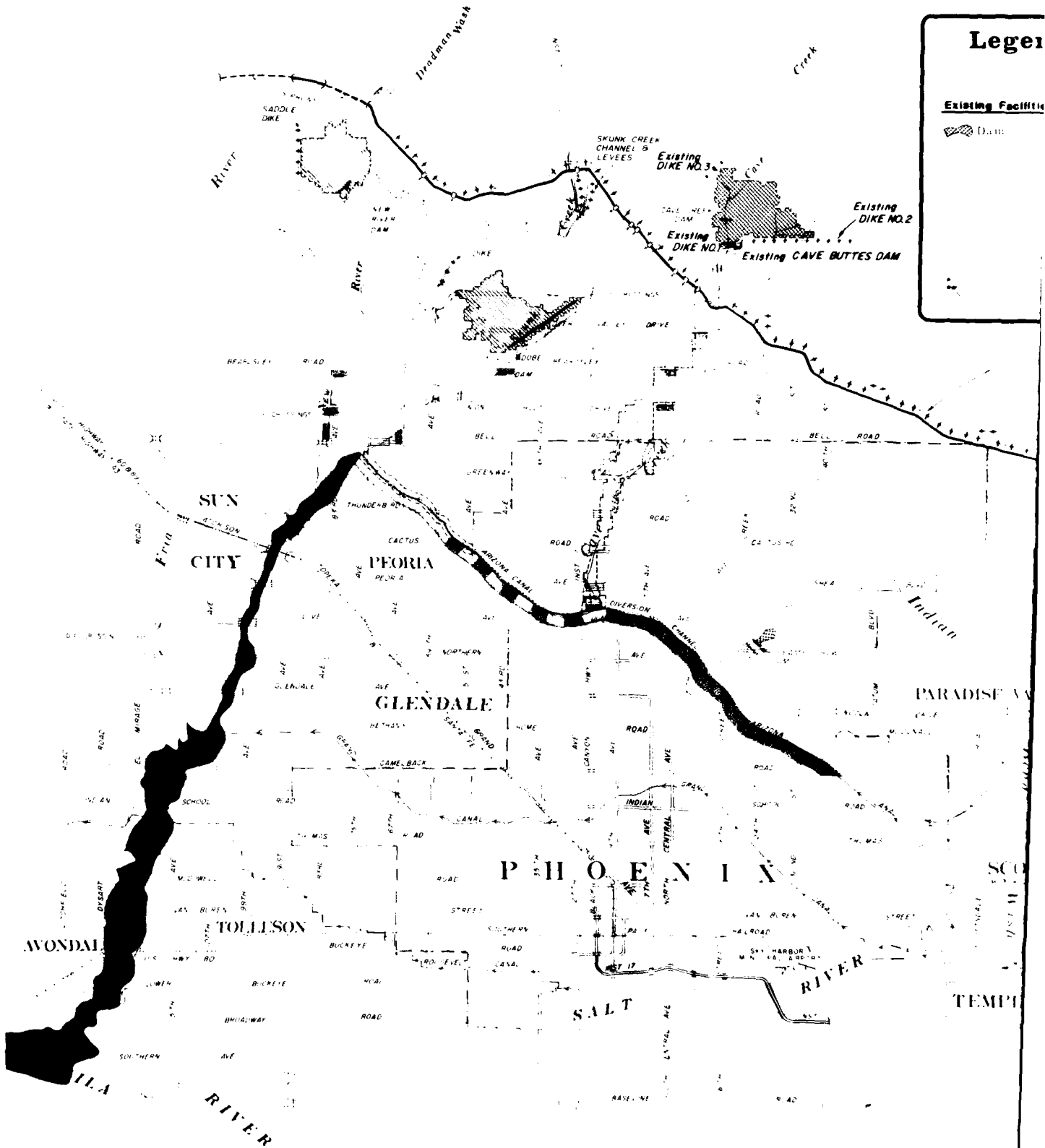
The undersigned, as chief legal officer for Maricopa County approves
the foregoing agreement as to form and legality this ____ day of _____,
19___. I have reviewed the contract in the light of the requirements
of Section 221 of Public Law 91-611. I further find that Maricopa County
is a legally constituted body having full legal authority to enter into
the foregoing agreement and to respond in damages in the event that it
fails to fulfill its contractual obligations.

(Title)

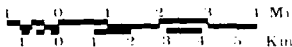
Legend

Existing Facilities

Dam



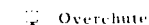
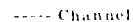
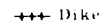
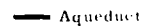
Legend



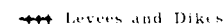
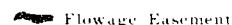
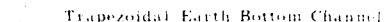
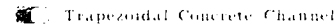
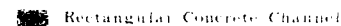
Existing Facilities**



Facilities Under Construction*

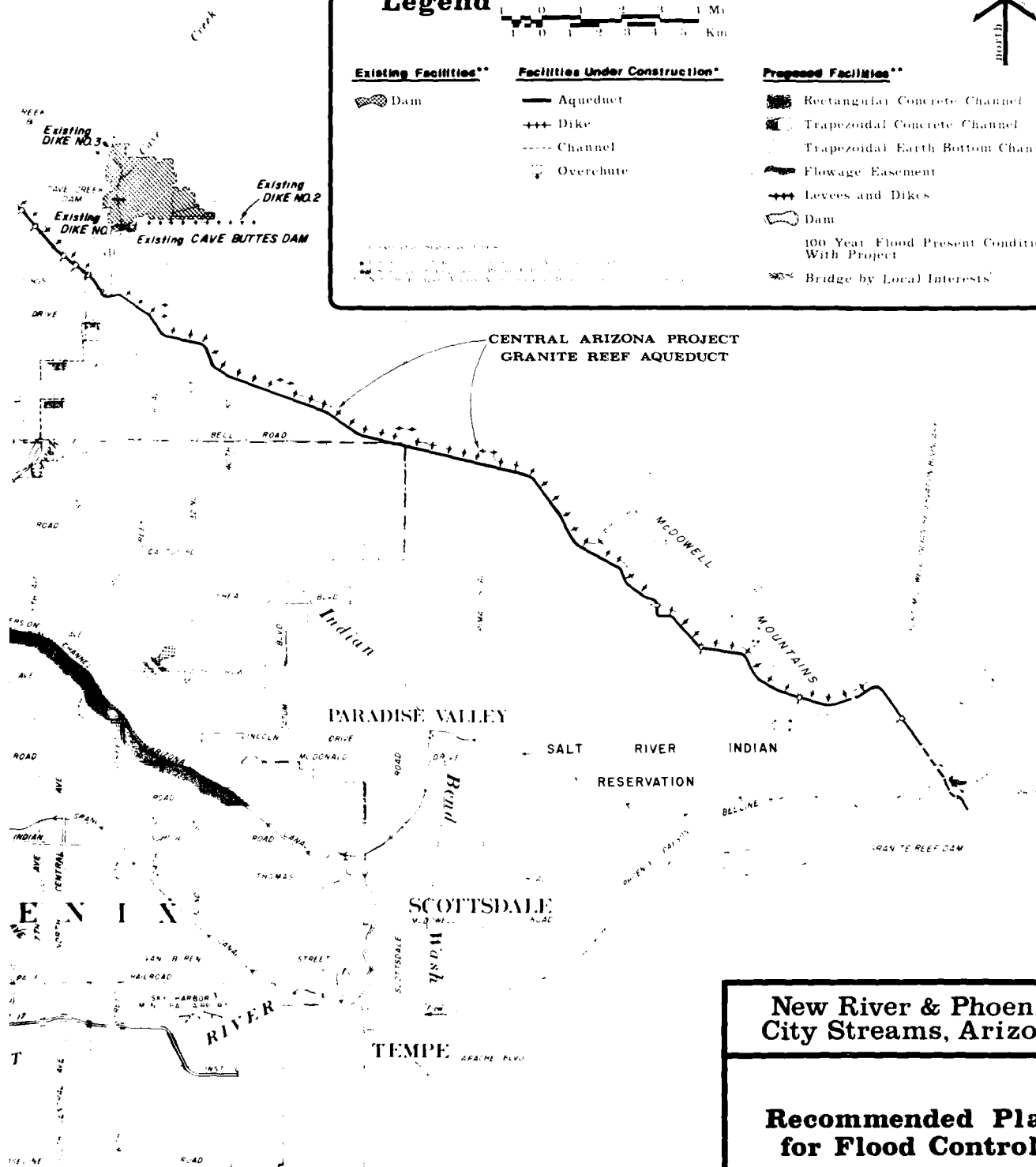


Proposed Facilities**



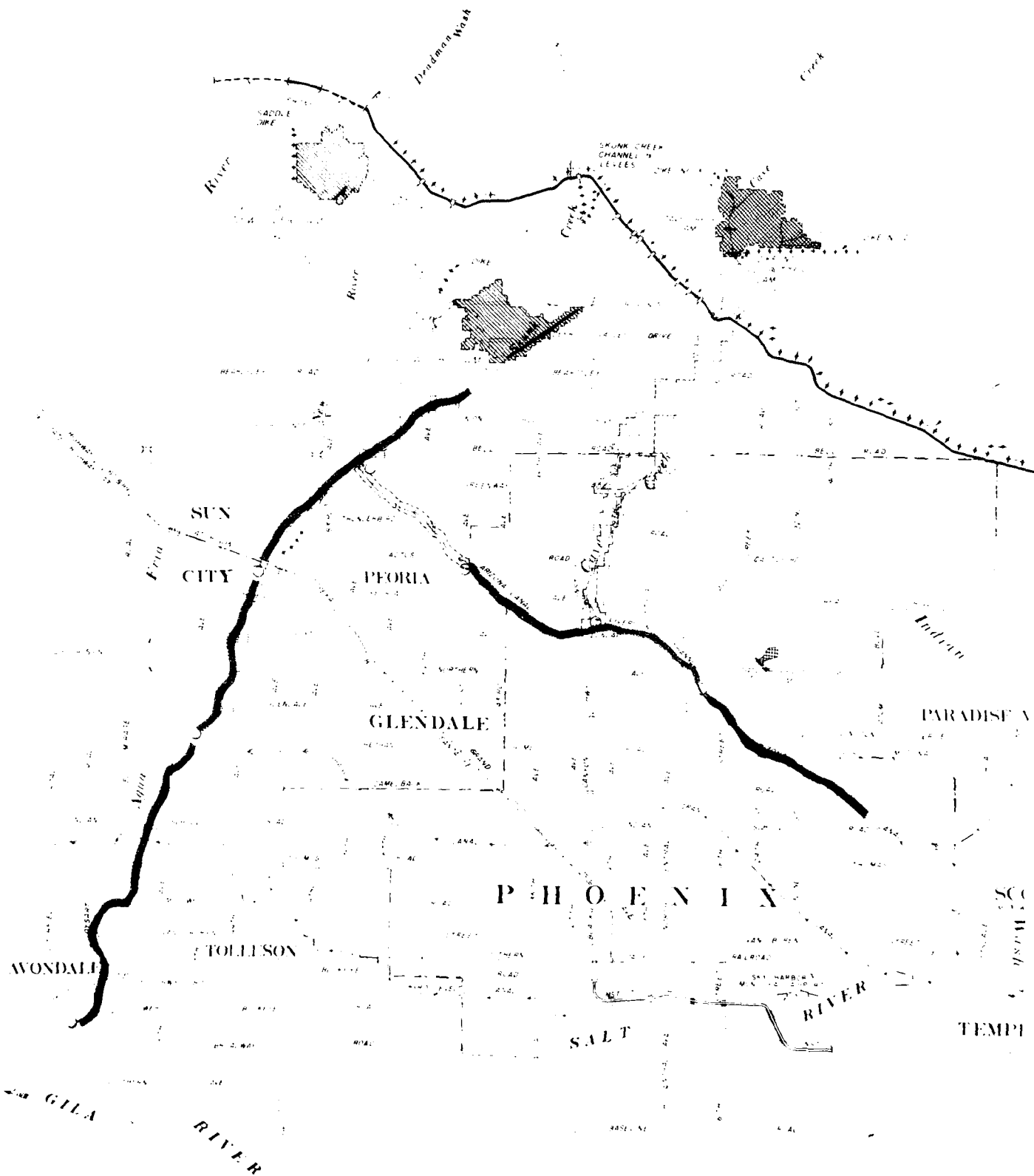
100 Year Flood Present Conditions
With Project

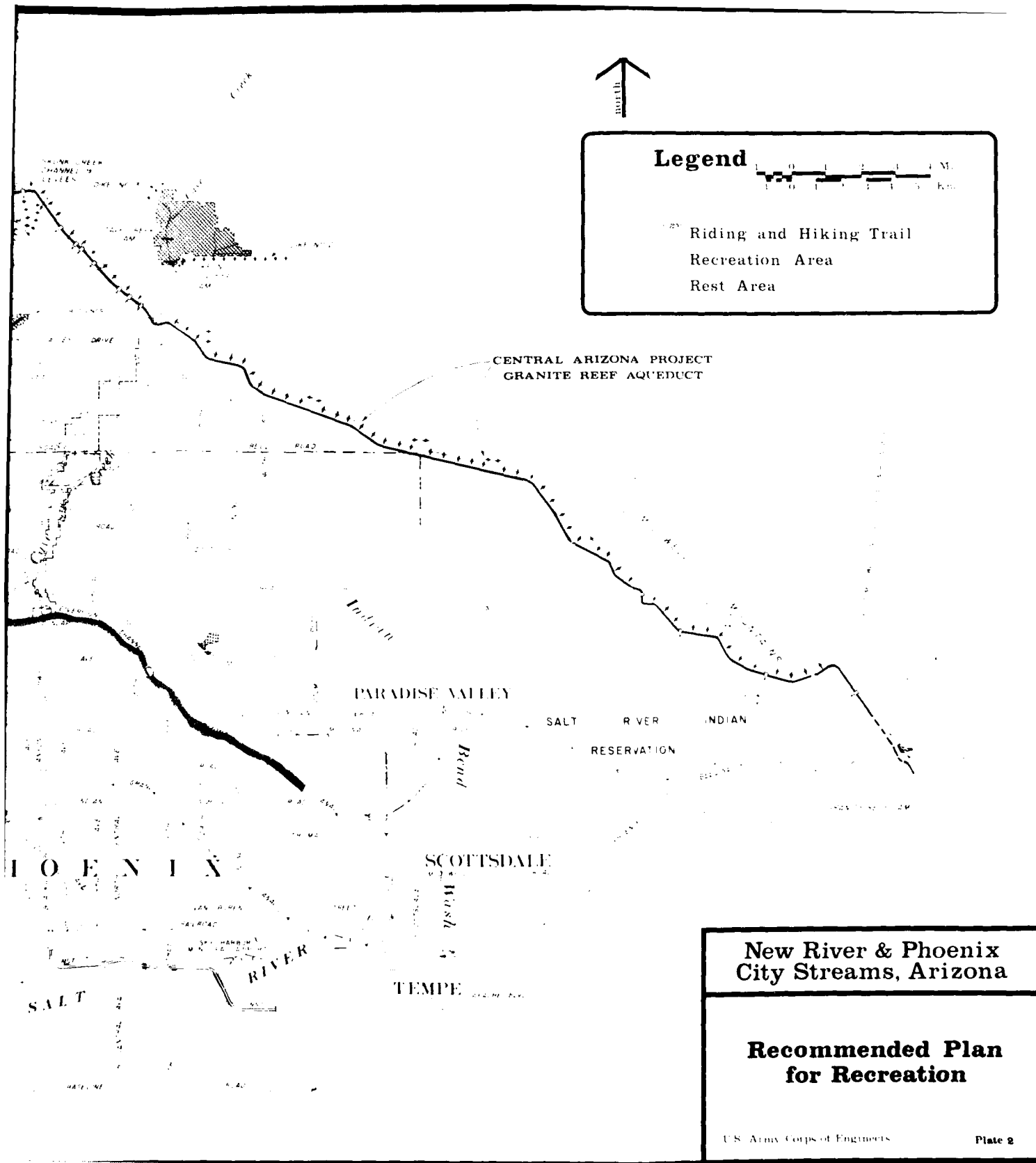
Bridge by Local Interests



New River & Phoenix
City Streams, Arizona

Recommended Plan
for Flood Control

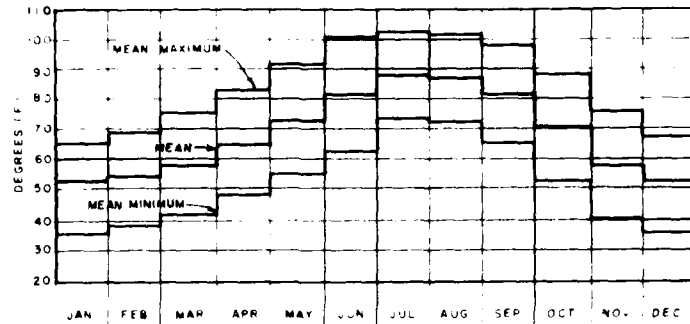




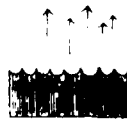
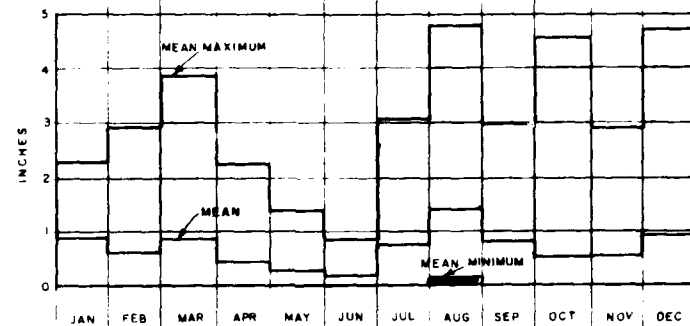
CLIMATOLOGIC SUMMARY



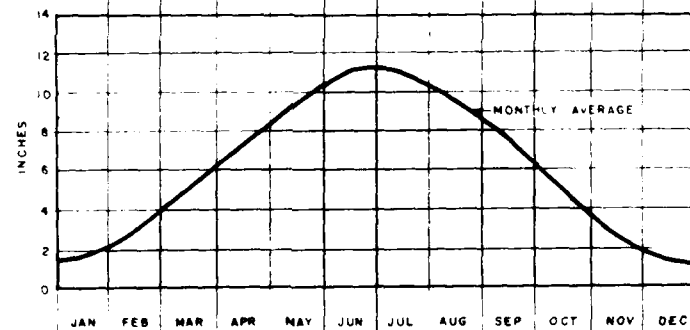
TEMPERATURE



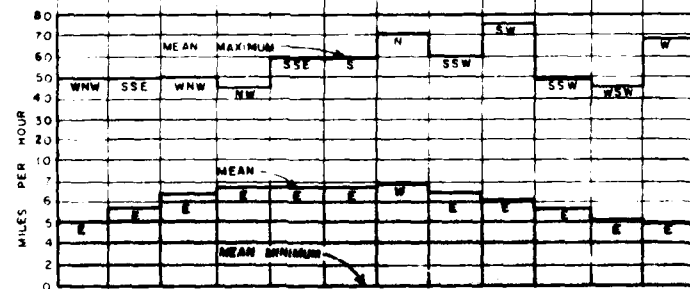
PRECIPITATION

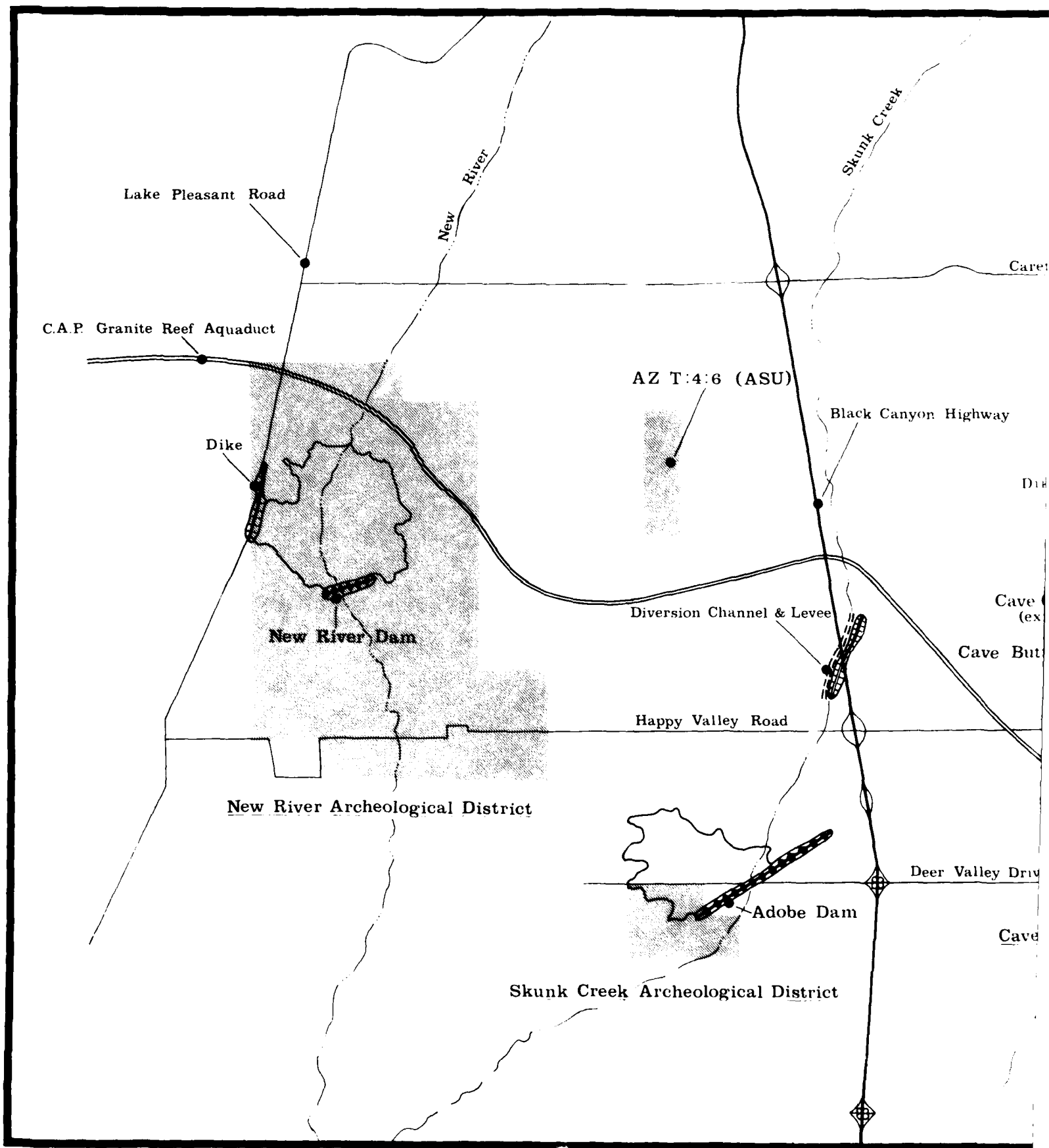


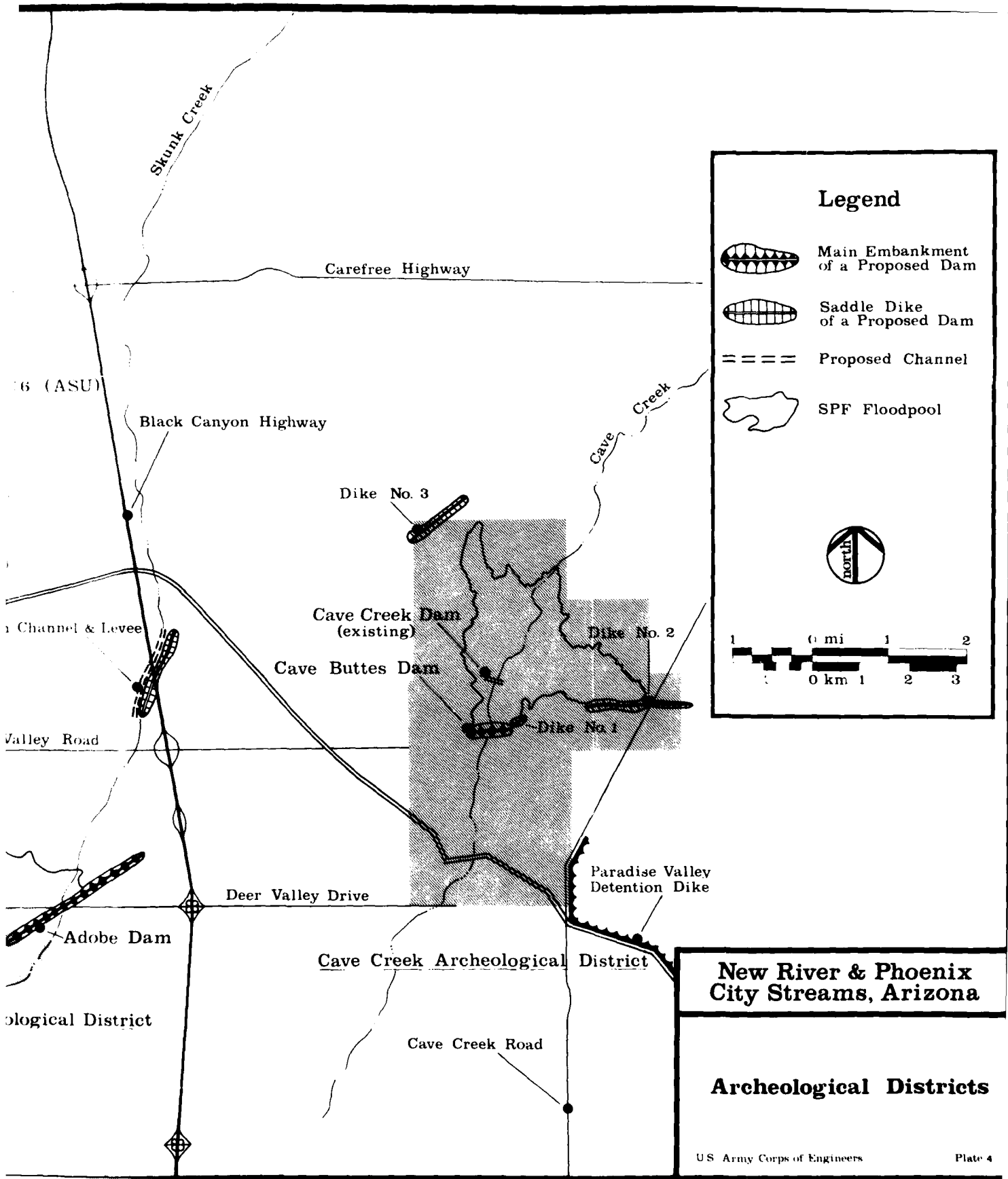
EVAPORATION



WIND

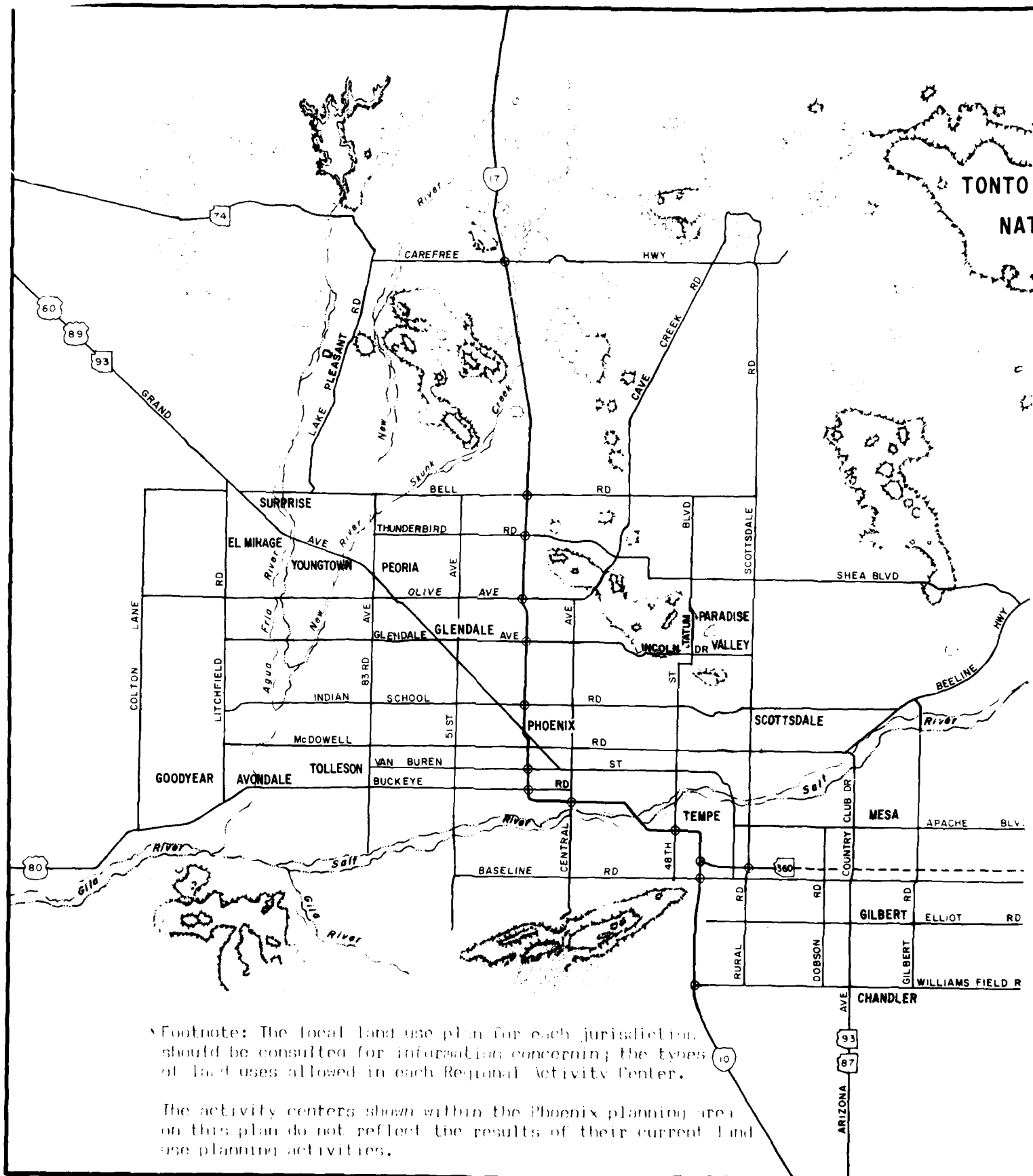


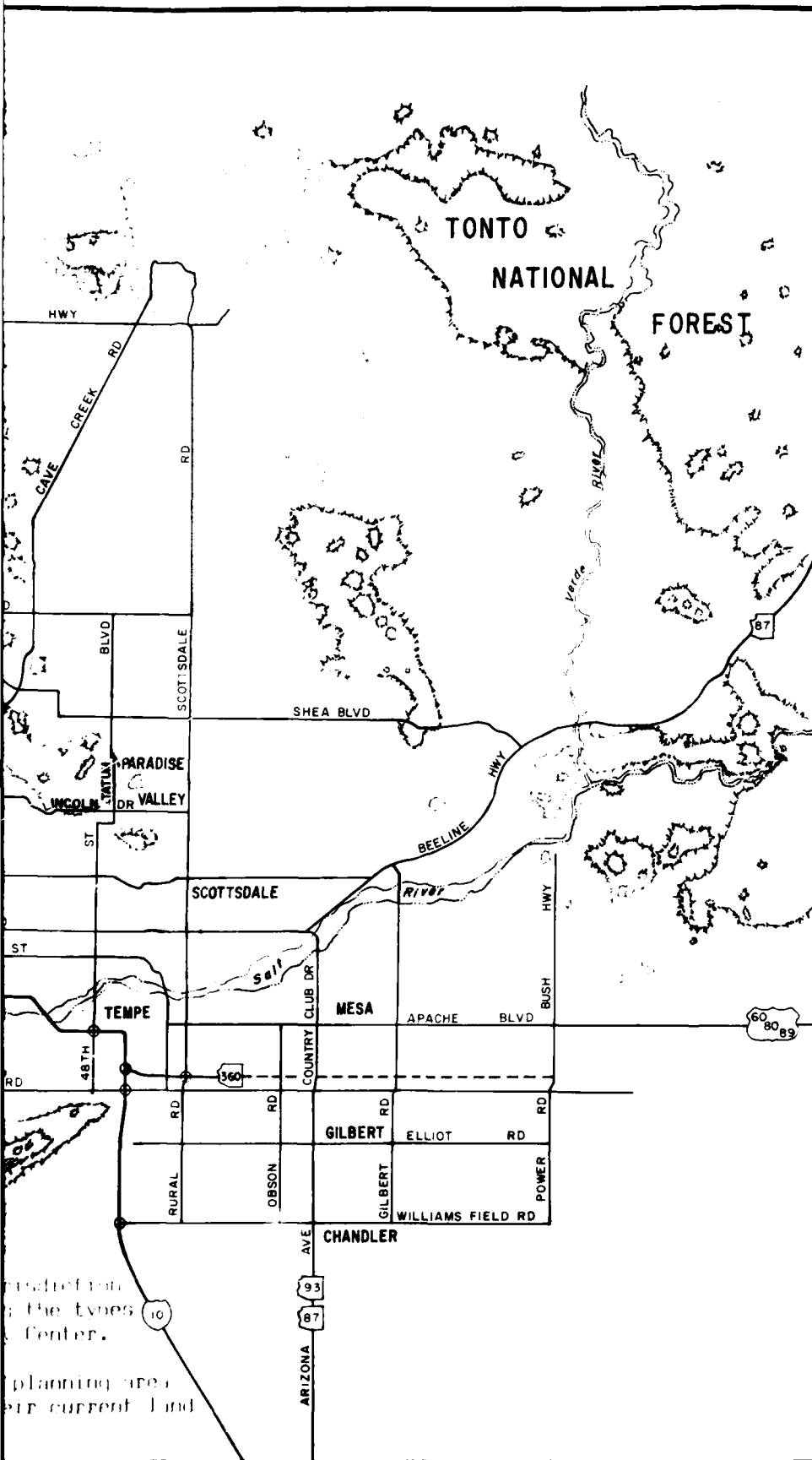




New River & Phoenix City Streams, Arizona

Archeological Districts





LEGEND

- REGIONAL ACTIVITY CENTER
- URBAN AREA
- IRRIGATED AGRICULTURE
- OPEN SPACE
- GENERAL RURAL



New River & Phoenix City Streams, Arizona

Maricopa Association of Governments Regional Development Plan

U.S. Army Corps of Engineers

Plate 5

New River and Phoenix City Streams, Arizona

Recreation Market Area

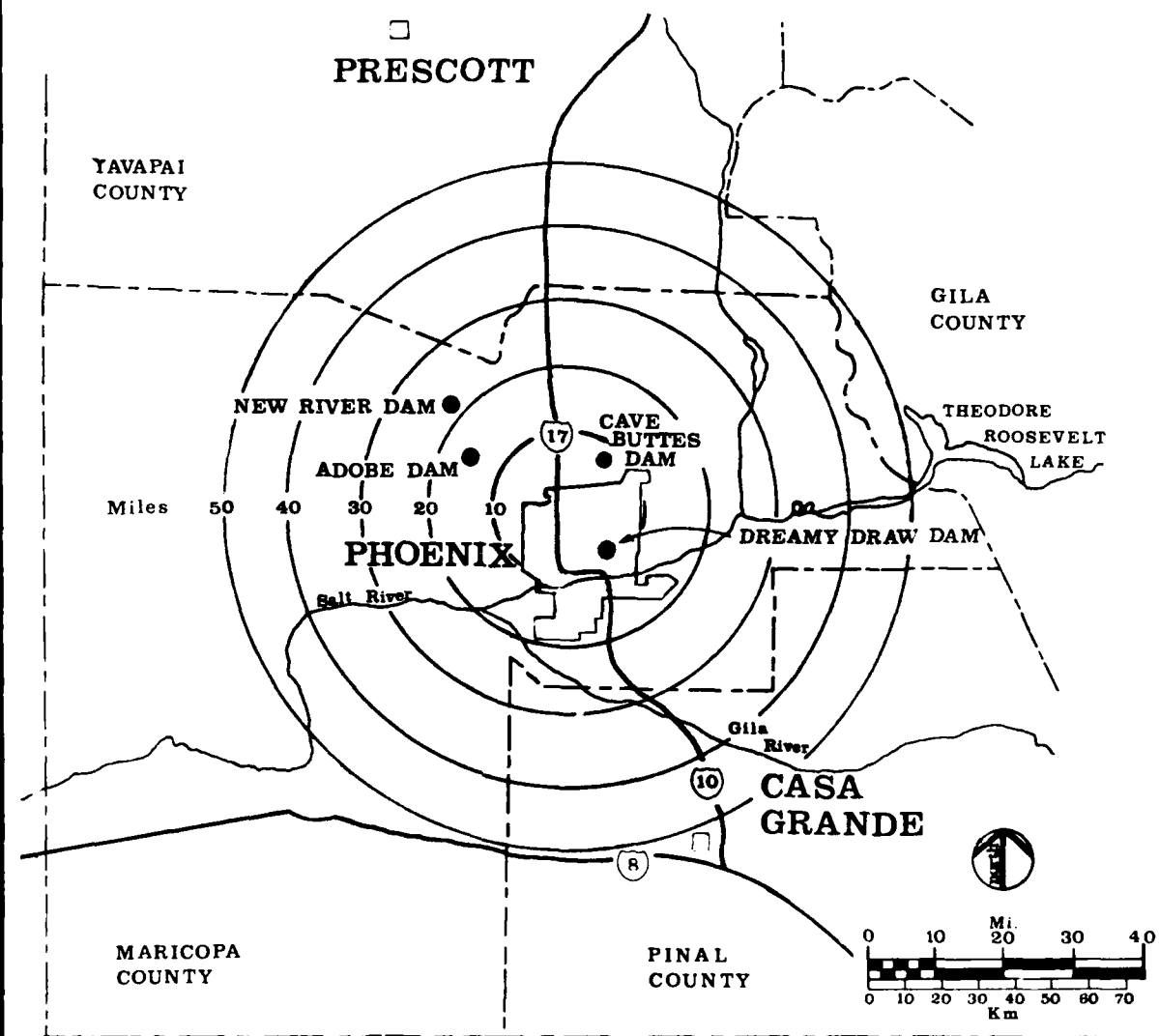
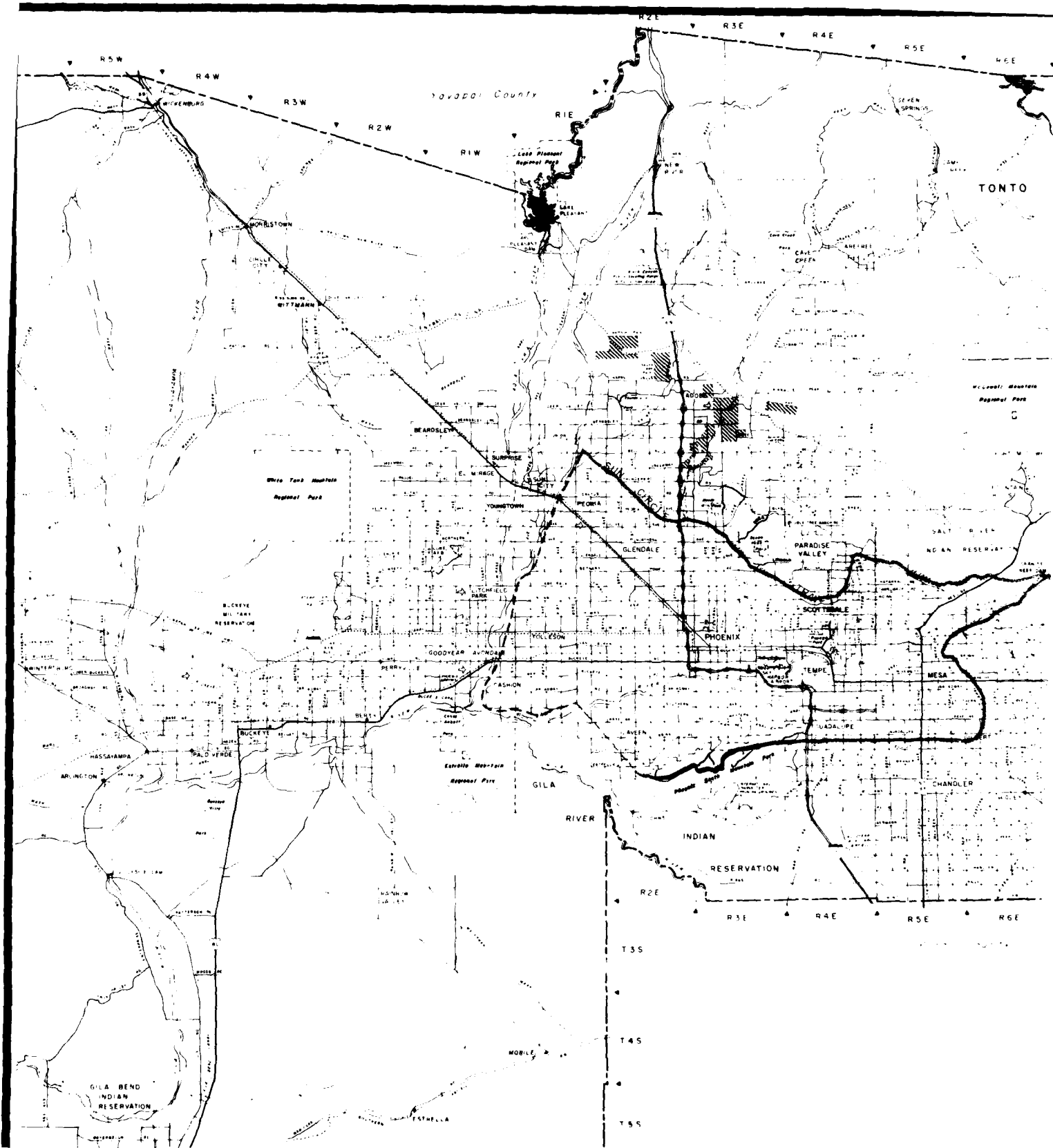
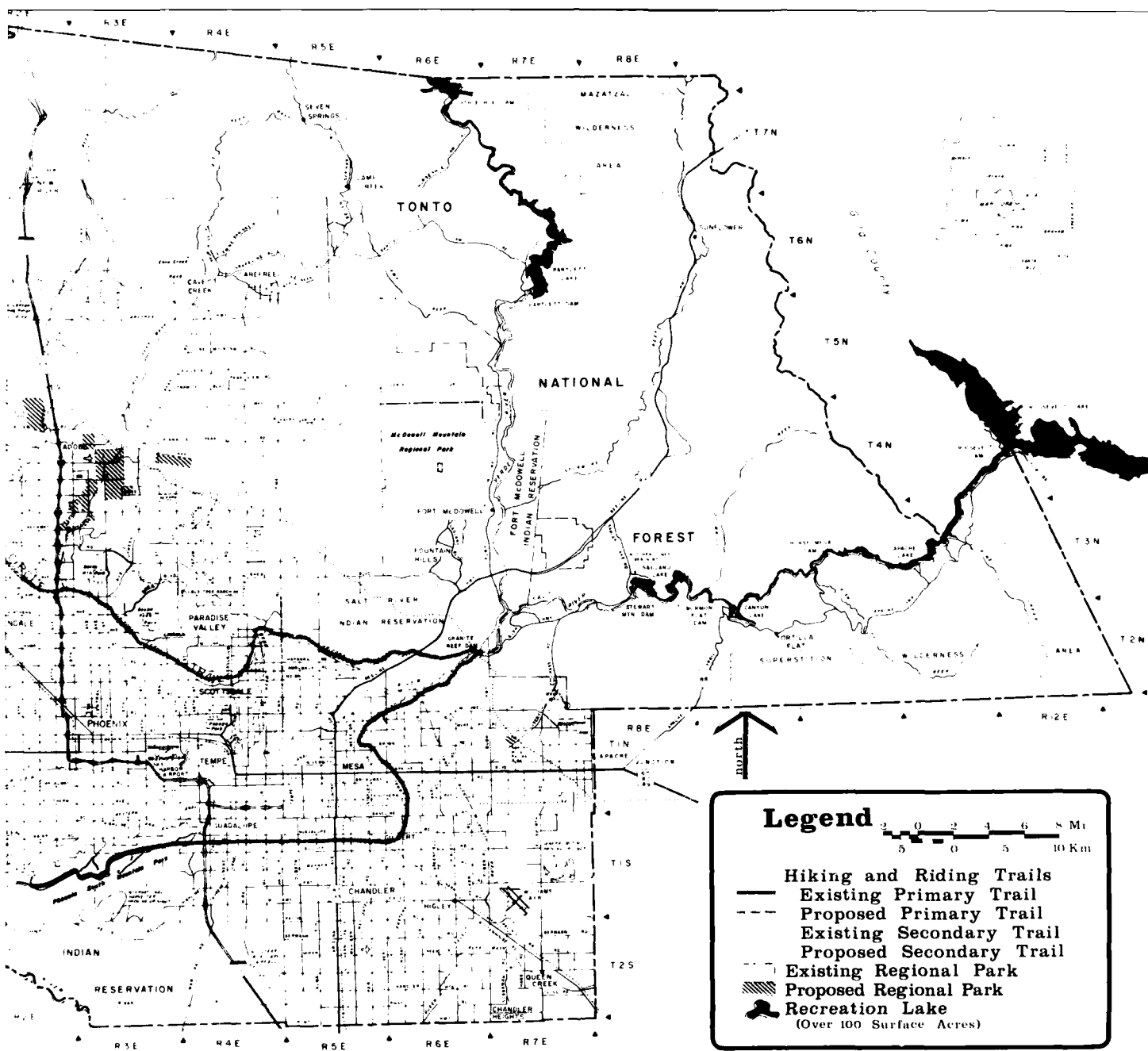


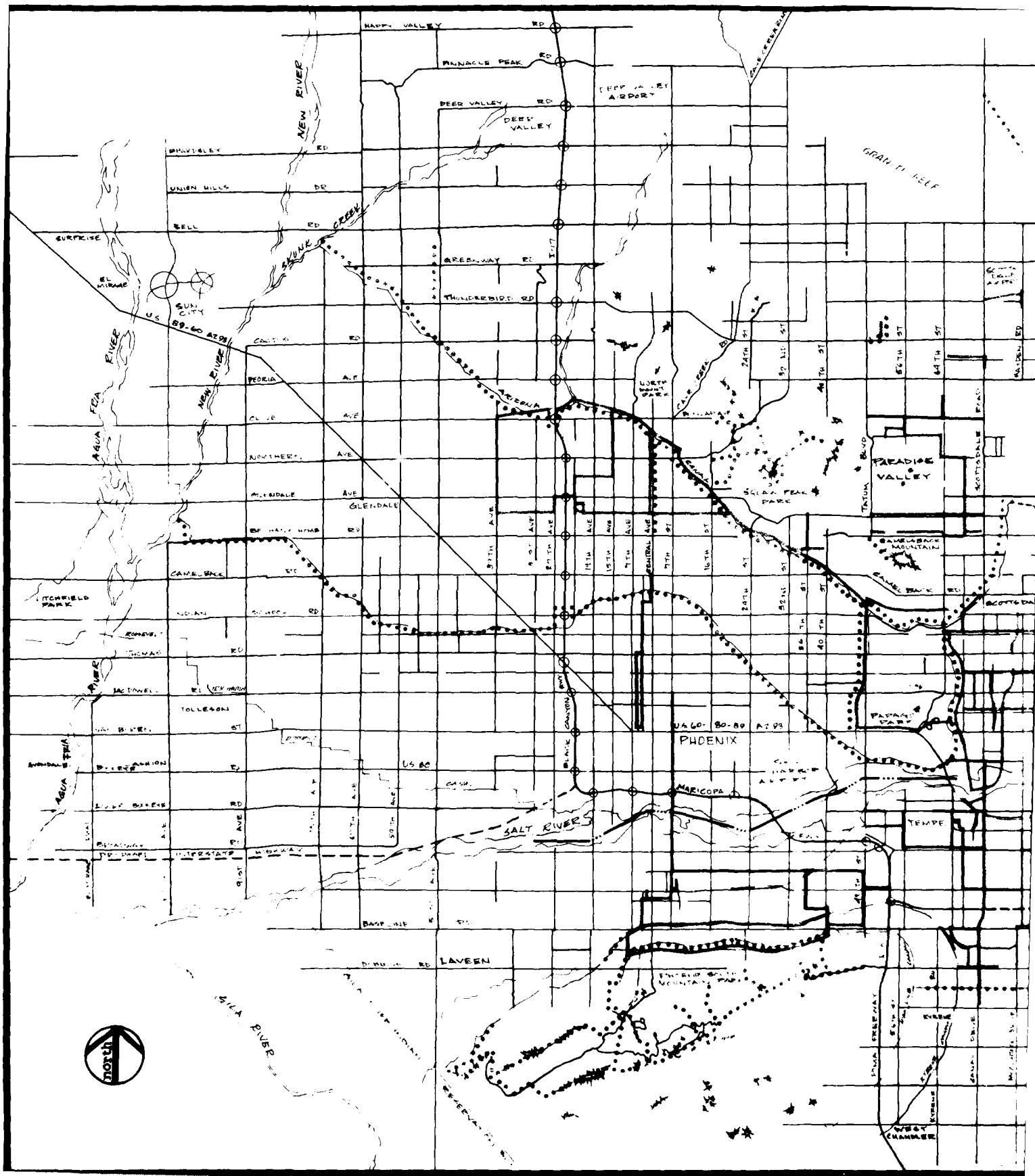
Plate 6

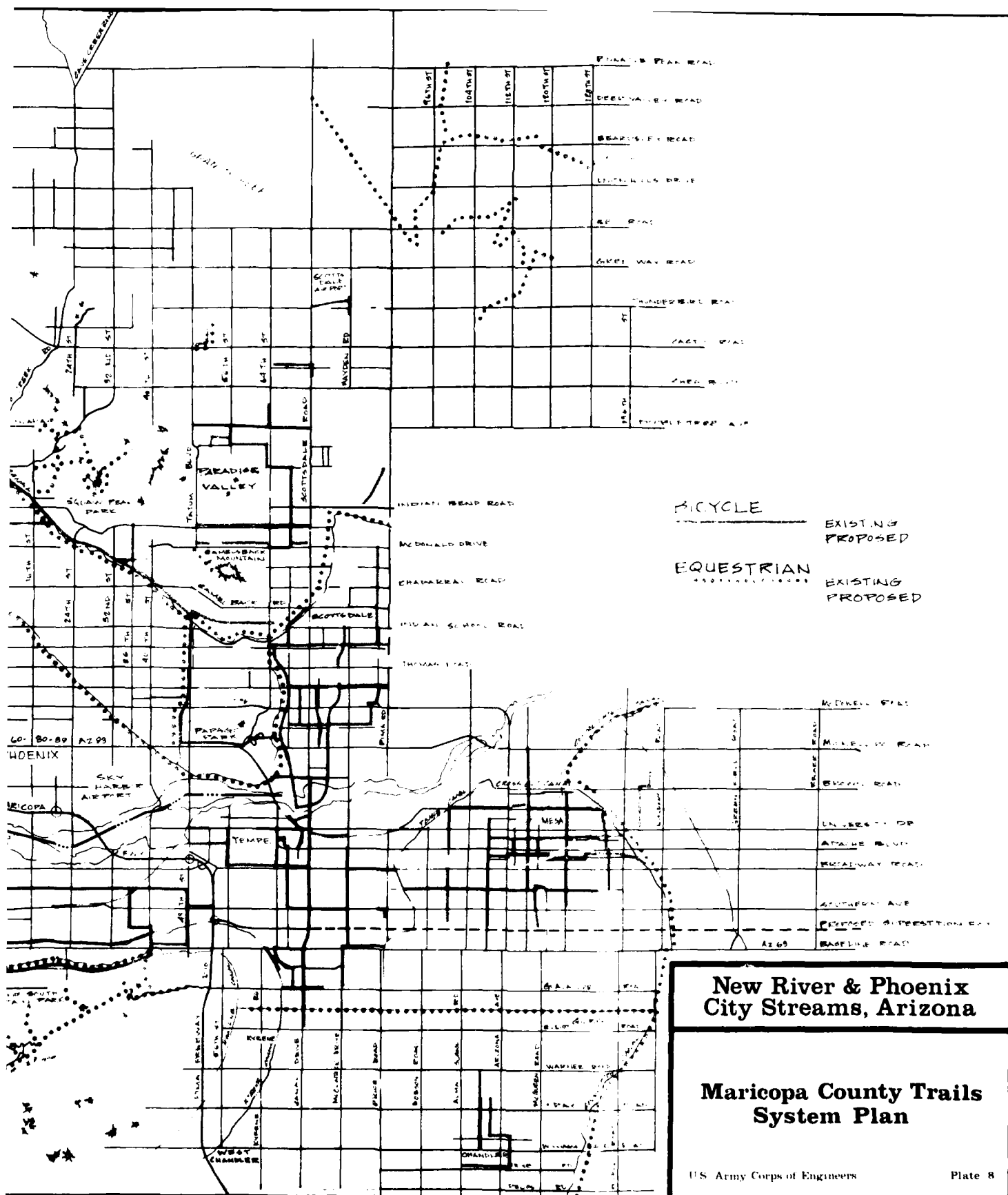




New River & Phoenix City Streams, Arizona

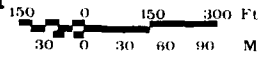
Recreation Resources in Maricopa County



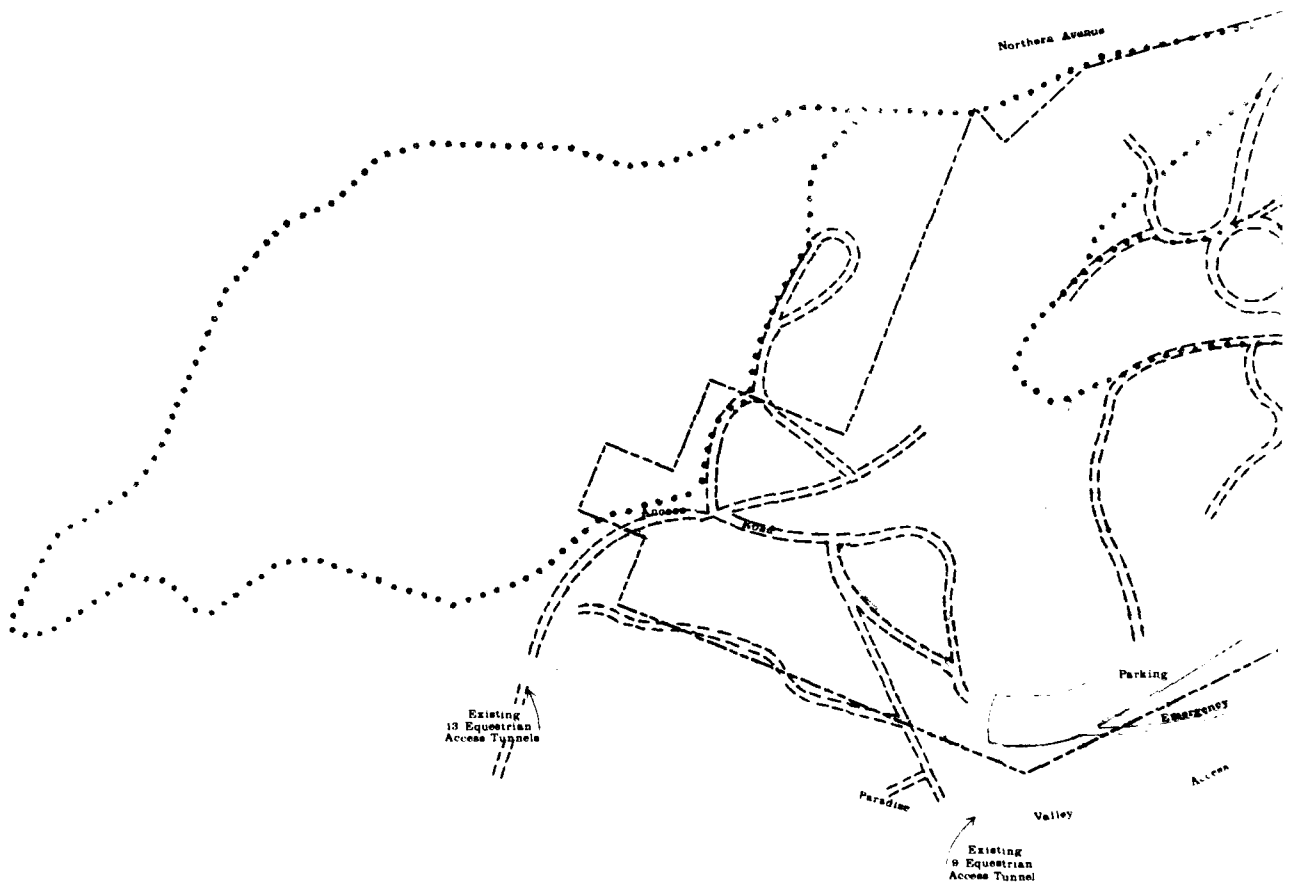


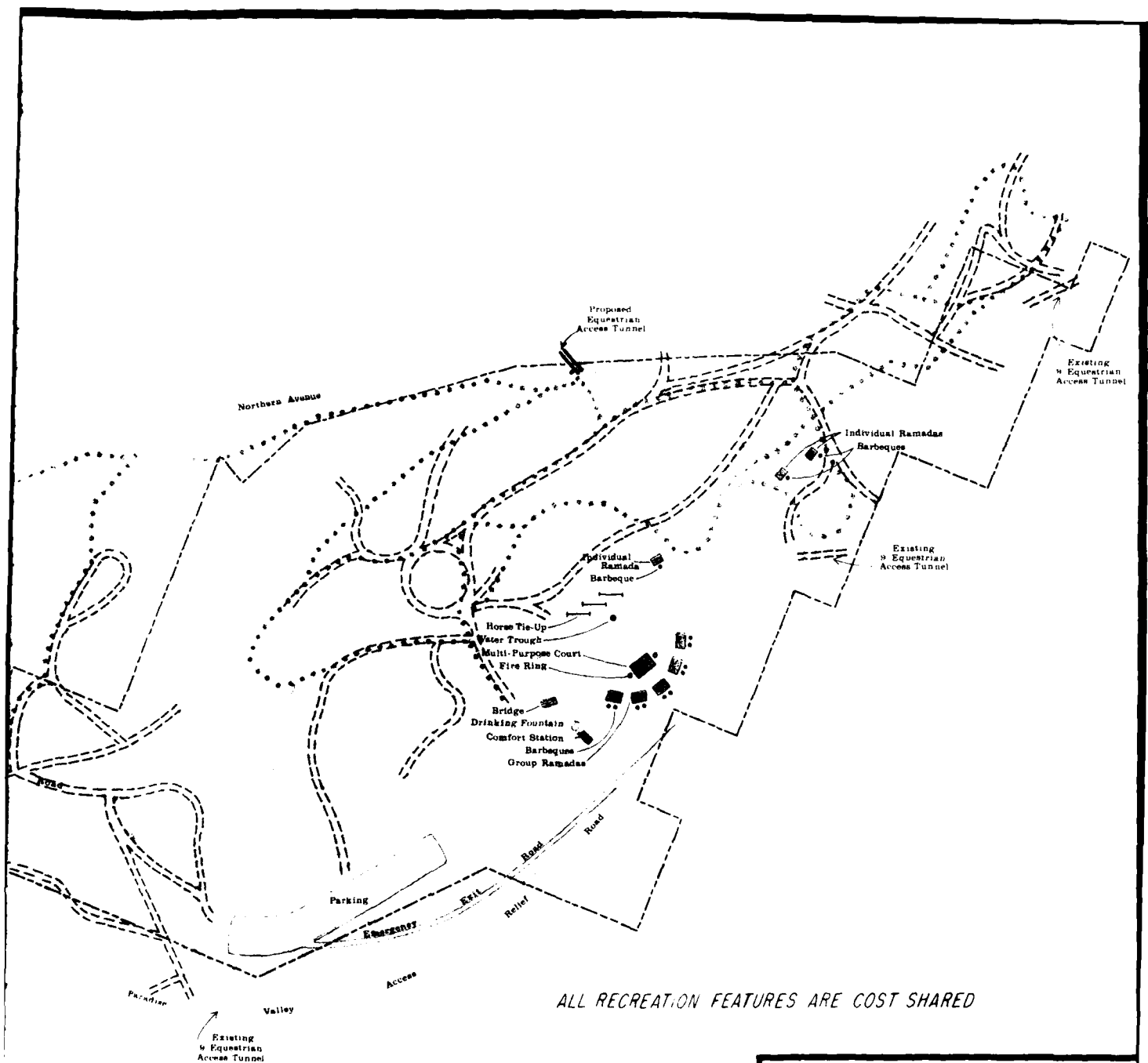


Legend



- ... Trail
- Existing Basin Road
- Project Boundary

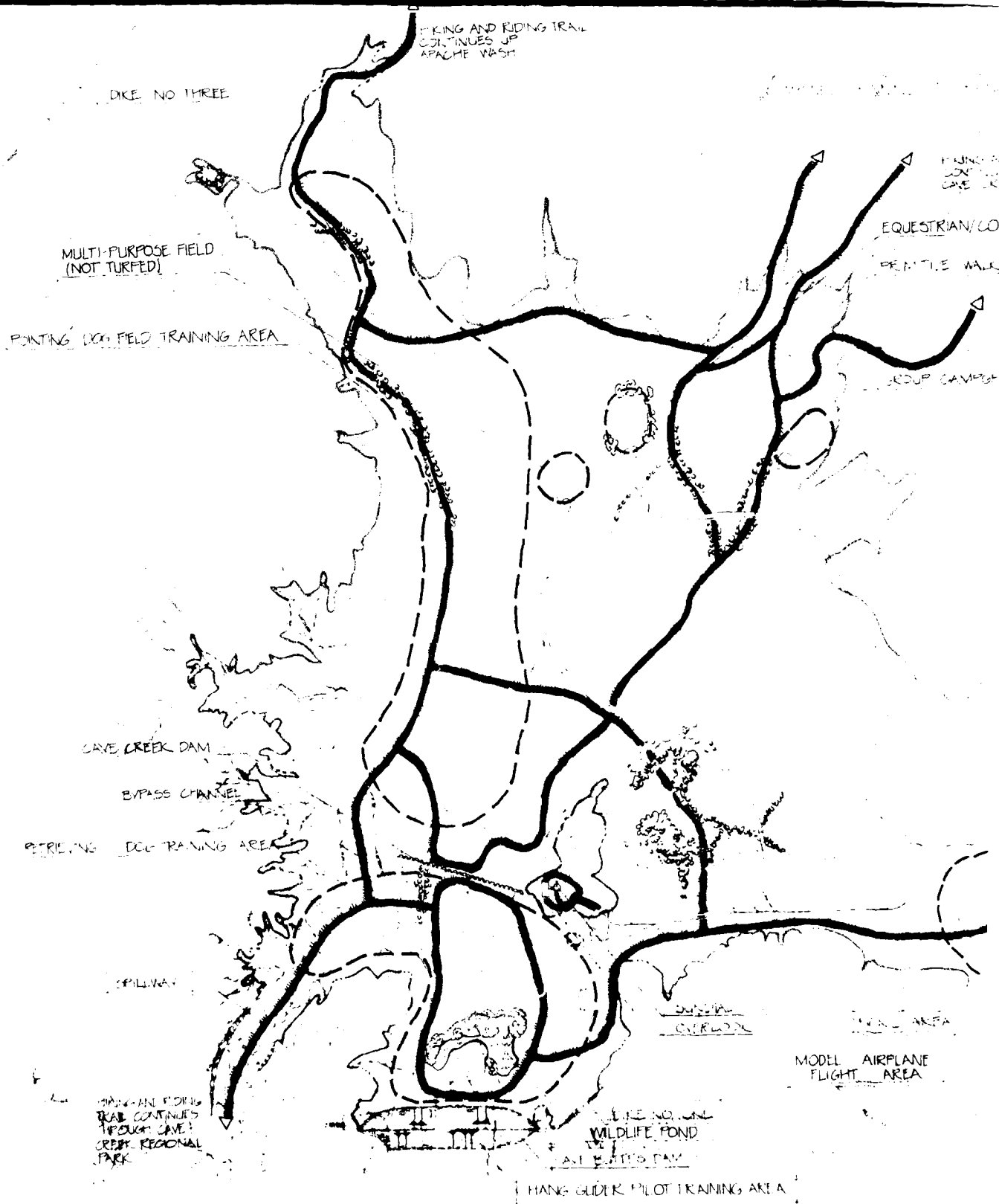


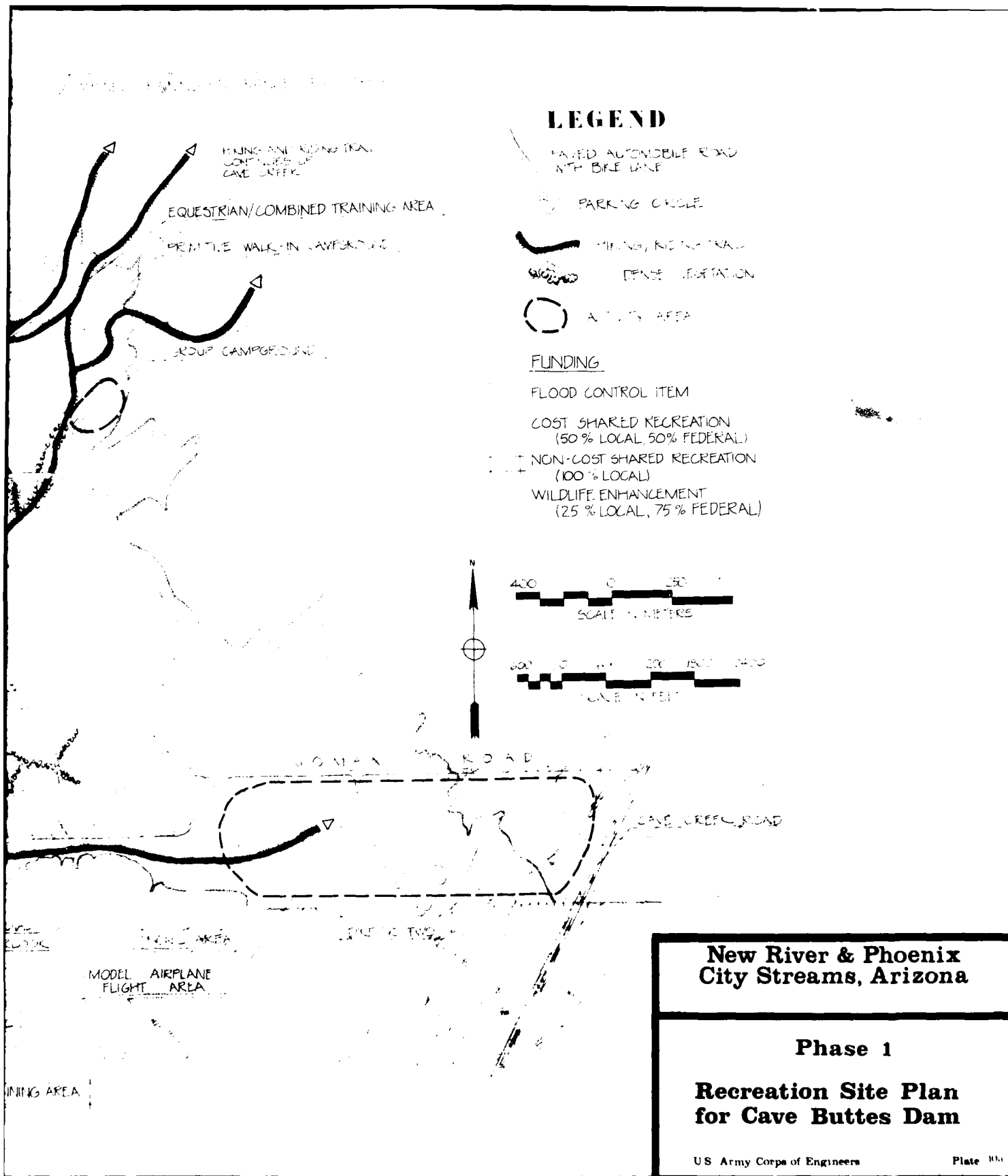


New River & Phoenix City Streams, Arizona

Recreation Site Plan for Dreamy Draw Dam

US Army Corps of Engineers





AD-A131 078

NEW RIVER AND PHOENIX CITY STREAMS ARIZONA OVERALL
MASTER PLAN(U) ARMY ENGINEER DISTRICT LOS ANGELES CALIF
SEP 80

3/3

UNCLASSIFIED

F/G 13/2

NL

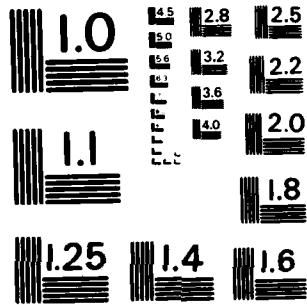
END

DATE

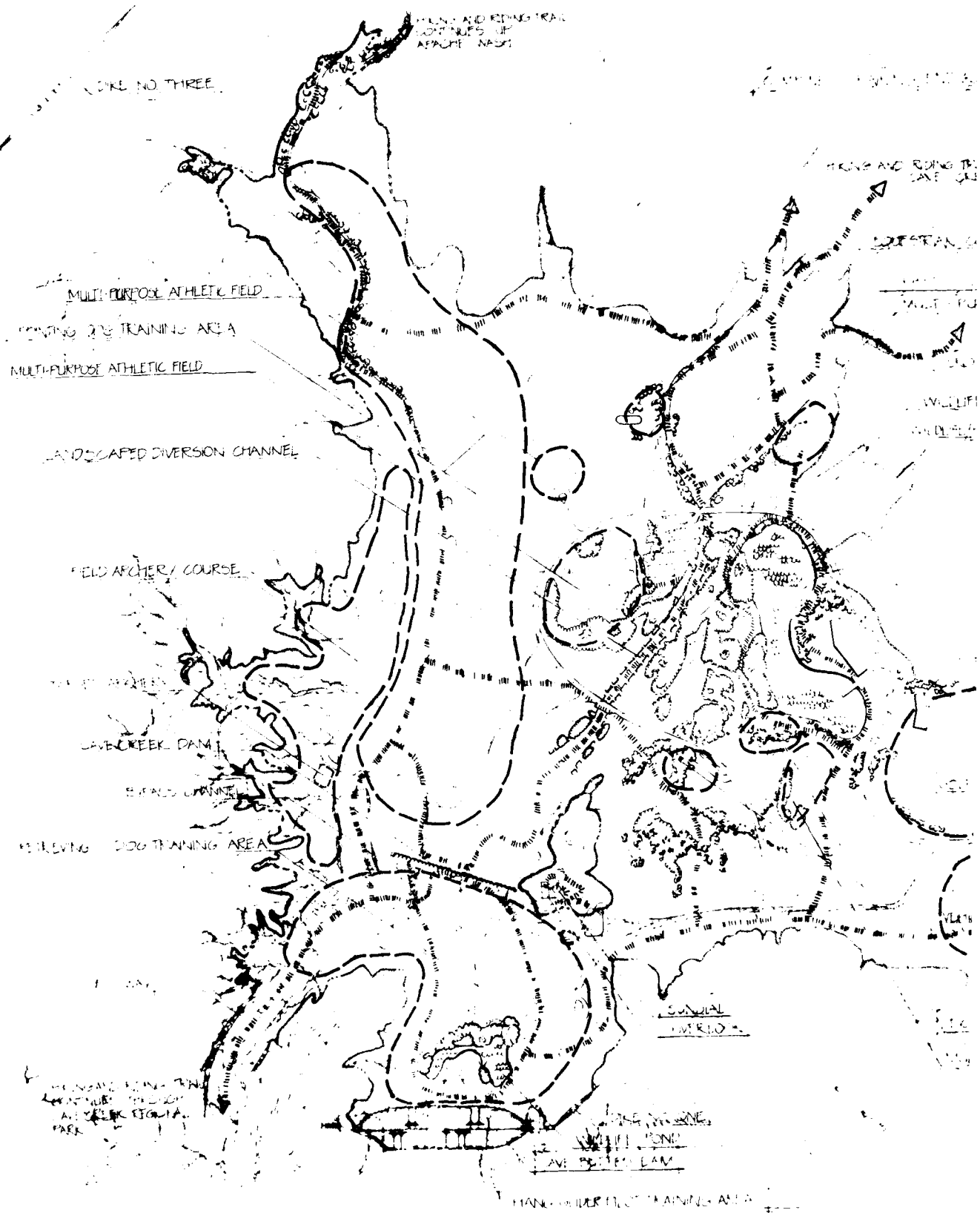
FILMED

9 83

DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



LEGEND

PAVED AUTOMOBILE ROAD
WITH BIKE LANE

PARKING CIRCLE

HIKING, RIDING TRAIL

DENSE VEGETATION

ACTIVITY AREA

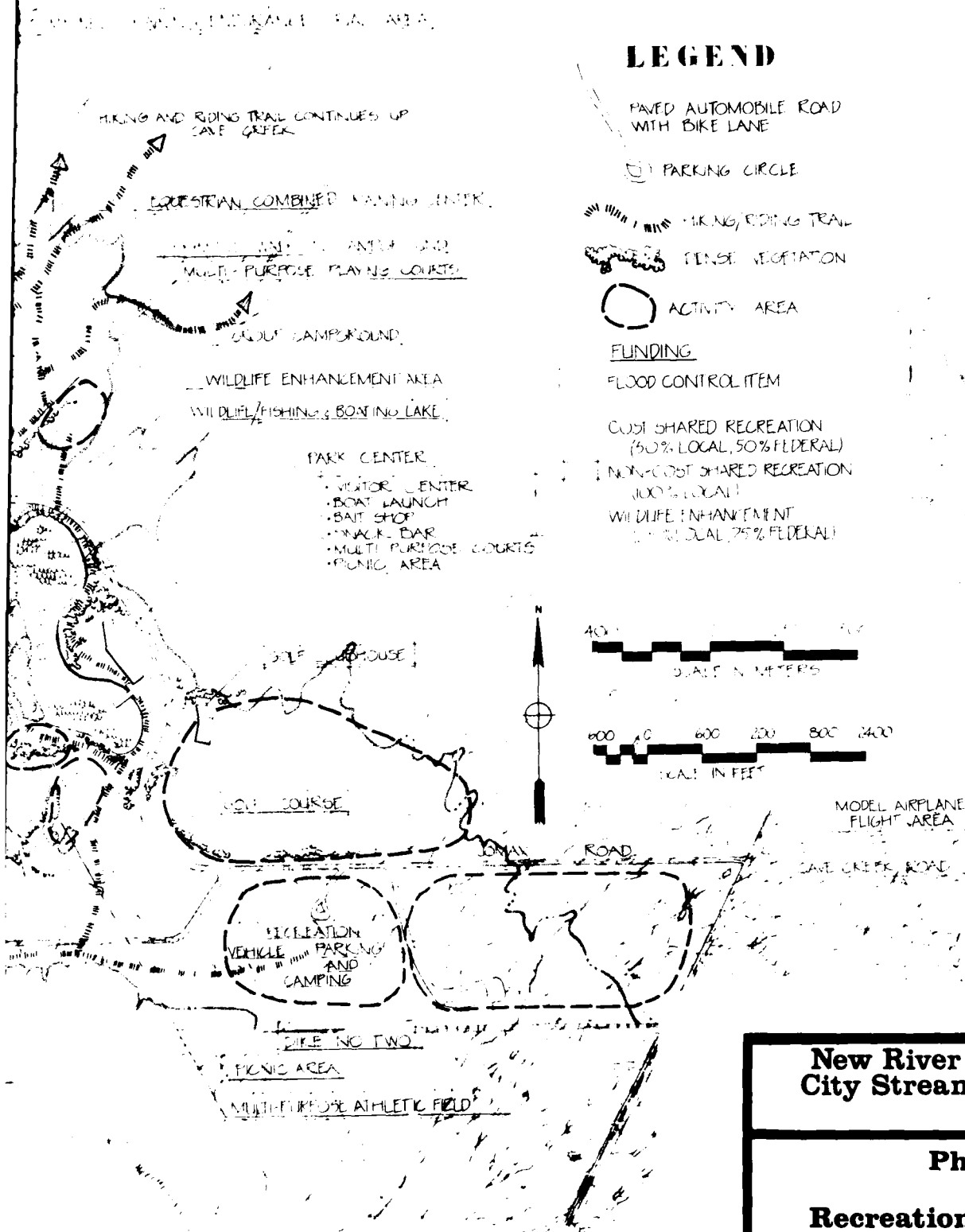
FUNDING

FLOOD CONTROL ITEM

COST SHARED RECREATION
(50% LOCAL, 50% FEDERAL)

NON-COST SHARED RECREATION
(100% LOCAL)

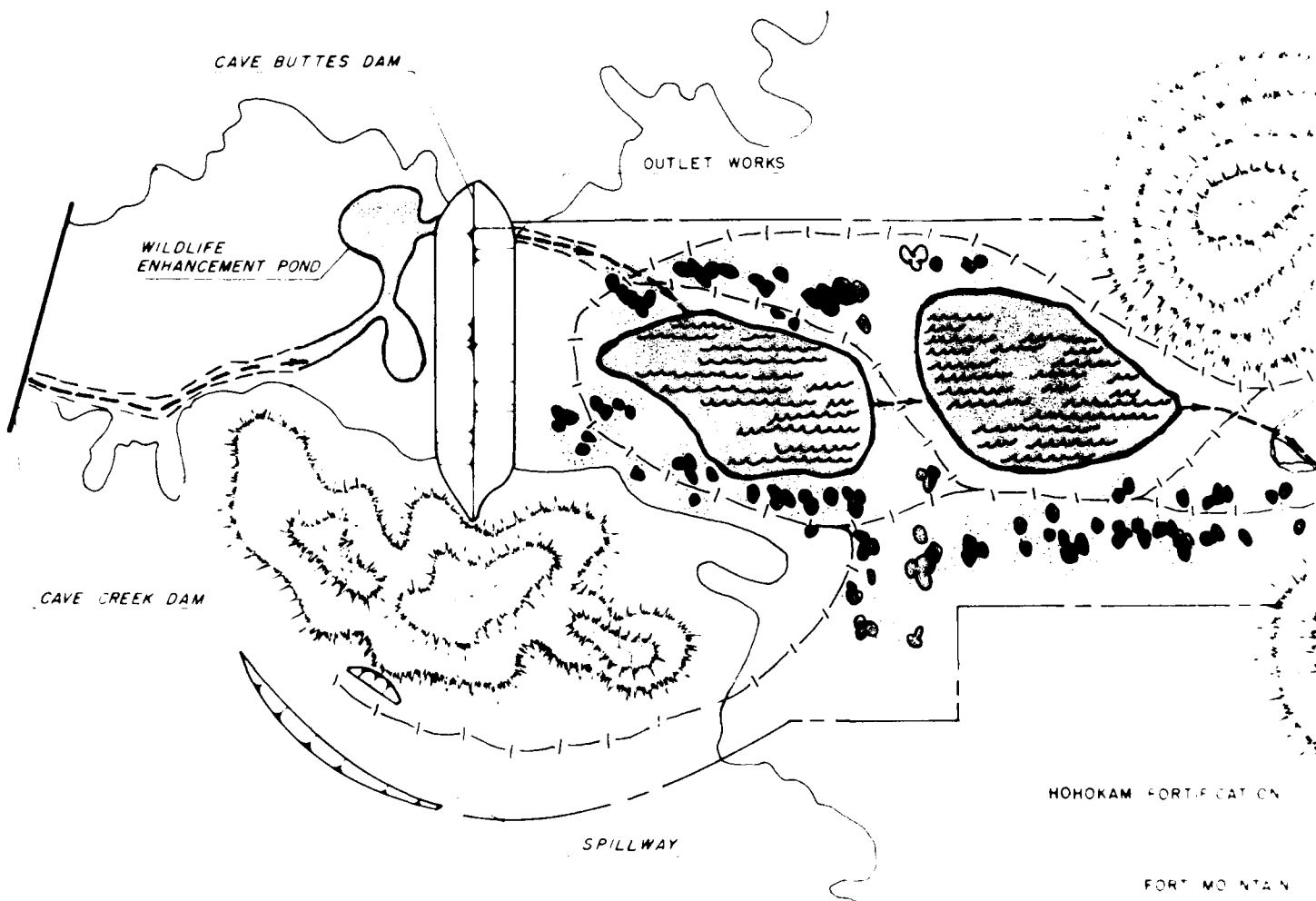
WILDLIFE ENHANCEMENT
(25% LOCAL, 75% FEDERAL)



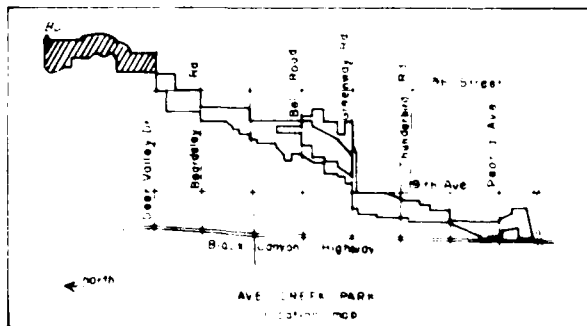
**New River & Phoenix
City Streams, Arizona**





Phase 2

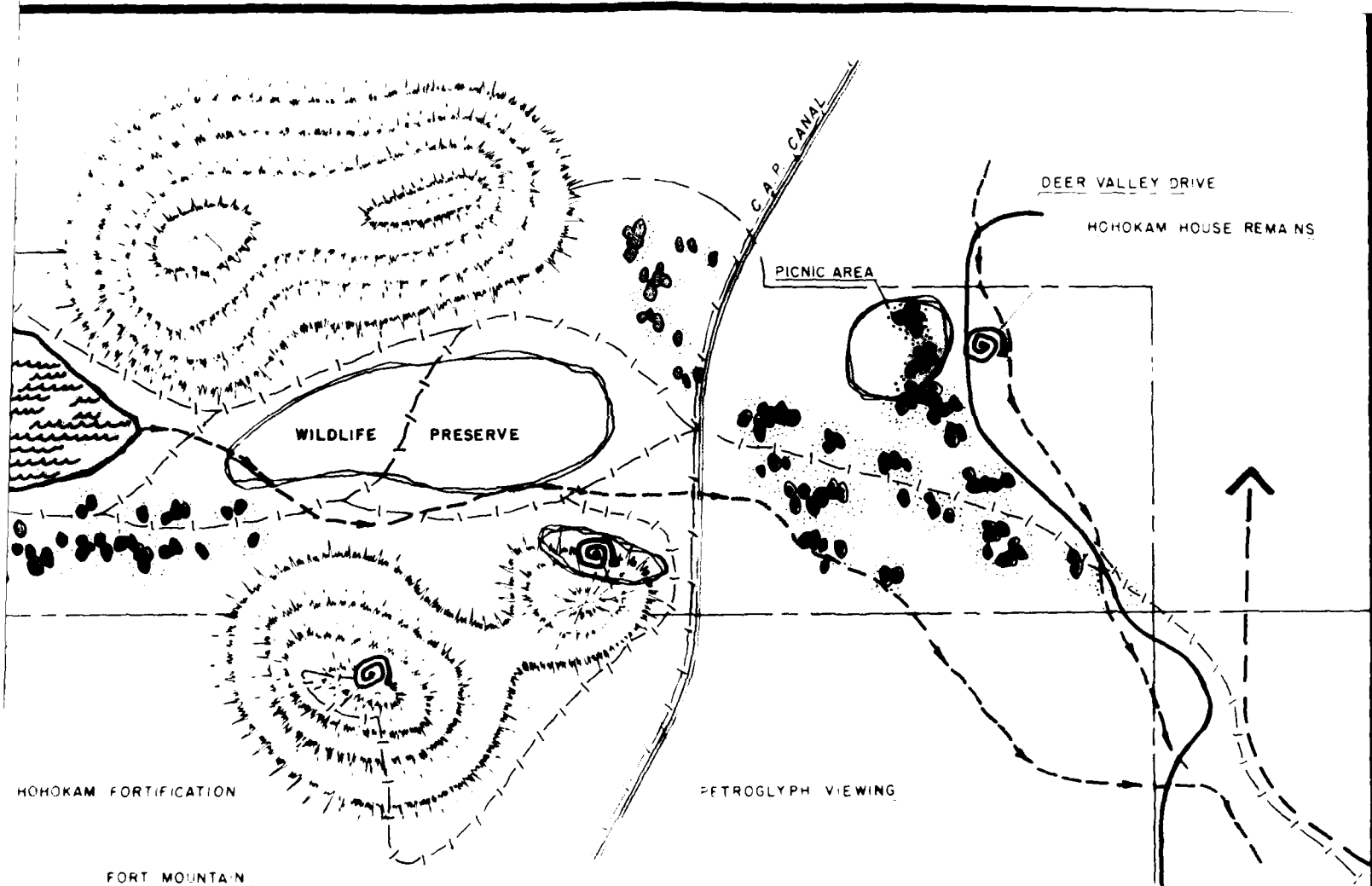
**Recreation Site Plan
for Cave Buttes Dam**



ALL RECREATION FEATURES BETWEEN CAVE



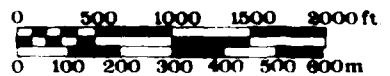
-  LAGOON
-  DENSELY PLANTED
-  ACTIVITY AREA
-  ARCHEOLOGICAL SITE



ATION FEATURES BETWEEN CAVE BUTTES DAM & DEER VALLEY DRIVE ARE 100% LOCAL RESPONSIBILITY

LEGEND

- | | |
|----------------------------|-------------------------|
| LAGOON | SCENIC DRIVE |
| DENSELY PLANTED VEGETATION | PROJECT BOUNDARY |
| ACTIVITY AREA | CAVE CREEK |
| ARCHEOLOGICAL SITE | RIDING AND HIKING TRAIL |

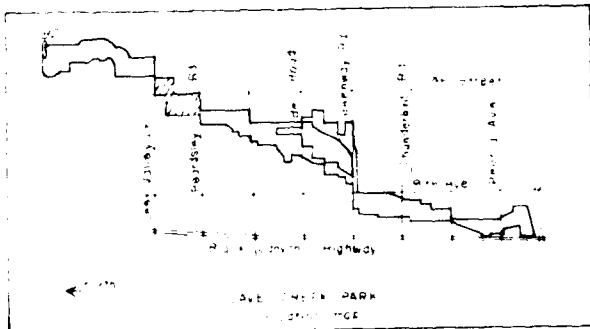
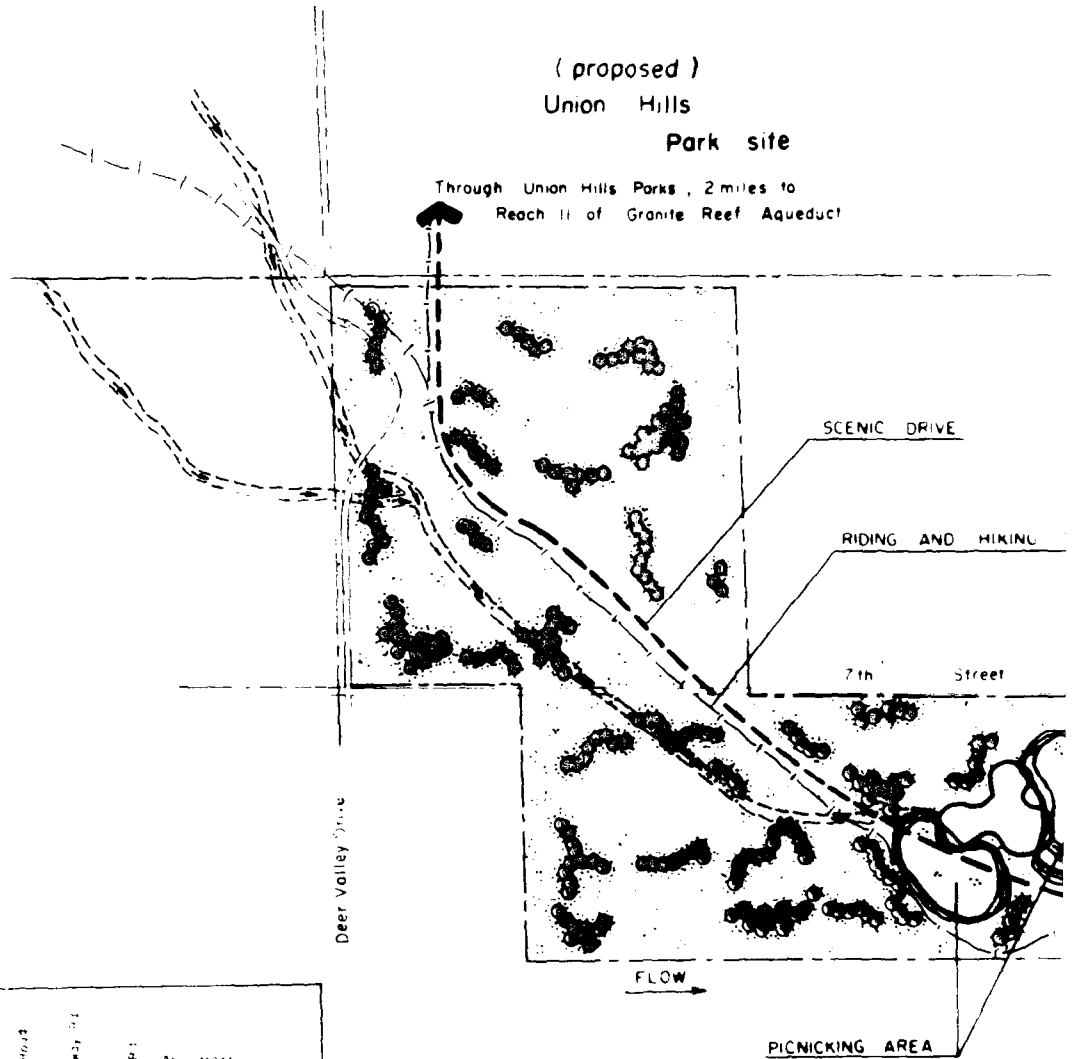


**New River & Phoenix
City Streams, Arizona**

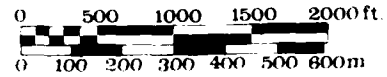
**Recreation Site Plan for
Cave Creek Regional Park**

(proposed)
 Union Hills
 Park site

Through Union Hills Parks, 2 miles to
 Reach II of Granite Reef Aqueduct

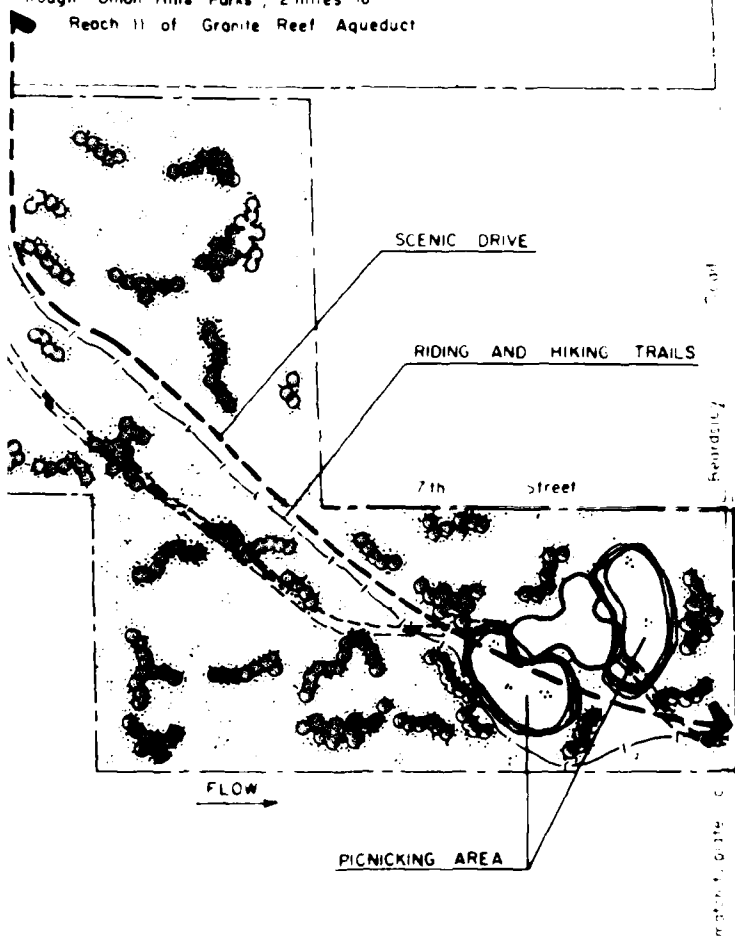


ALL RECREATION FEATURES BETWEEN DEER VALLEY DRIVE & BEARDS
 ARE 100% LOCAL RESPONSIBILITY



(proposed)
Union Hills
Park site

Through Union Hills Parks, 2 miles to
Reach II of Granite Reef Aqueduct



LEGEND



DENSELY PLANTED
VEGETATION



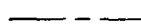
ACTIVITY AREA



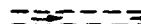
ARCHEOLOGICAL SITE



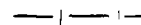
SCENIC DRIVE



PROJECT BOUNDARY



CAVE CREEK



RIDING AND HIKING TRAIL

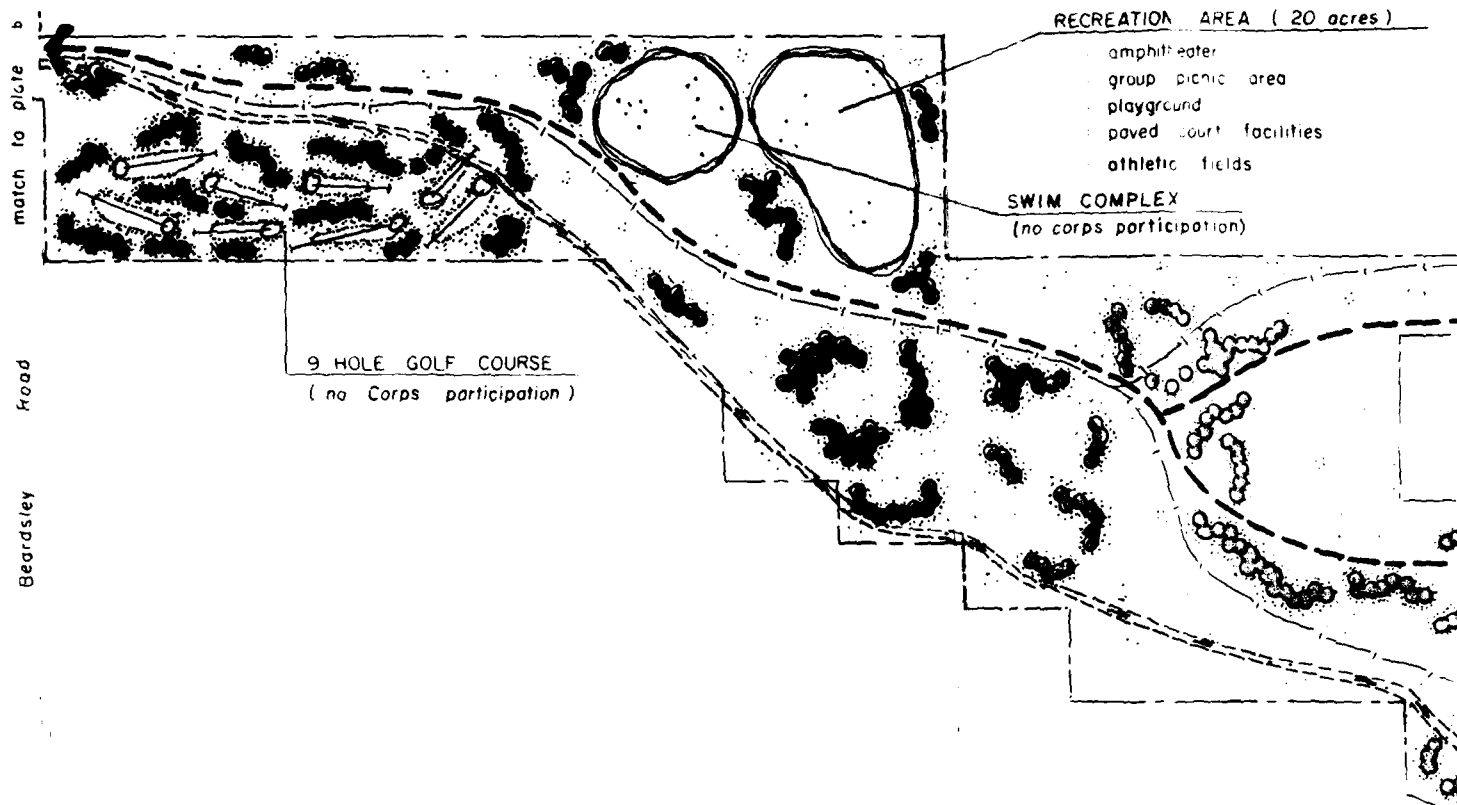
**New River & Phoenix
City Streams, Arizona**

**Recreation Site Plan for
Cave Creek Regional Park**

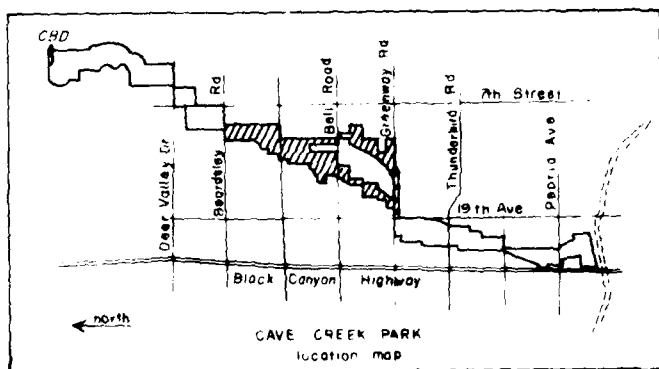
U.S. Army Corps of Engineers

Plate III

CREATION FEATURES BETWEEN DEER VALLEY DRIVE & BEARDSLEY ROAD
% LOCAL RESPONSIBILITY

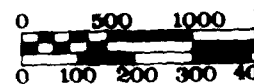


ALL RECREATION FEATURES BETWEEN BEARDSLEY ROAD & GREENWAY ROAD ARE 100% LOCAL RESPONSIBILITY.



Drive
Hills
Union

PLAYGROUND (1/2 acre)
 play apparatus
 multi-purpose
 athletic fields



AREA (20 acres)

ster
cnic area
id
ourt facilities
fields

PLAYGROUND (4 acres)

play apparatus
multi-purpose courts
athletic fields

FLOW

PRIVATELY

PICNICKING AREA

OWNED

EQUESTRIAN CENTER

LAND

PLAYGROUND (12 acres)

play apparatus
multi-purpose courts
athletic fields

PICNICKING AREA

MODEL BOATING

ORCHARD DEVELOPMENT
(no Corps participation)

PICNICKING AREA

Bell Road

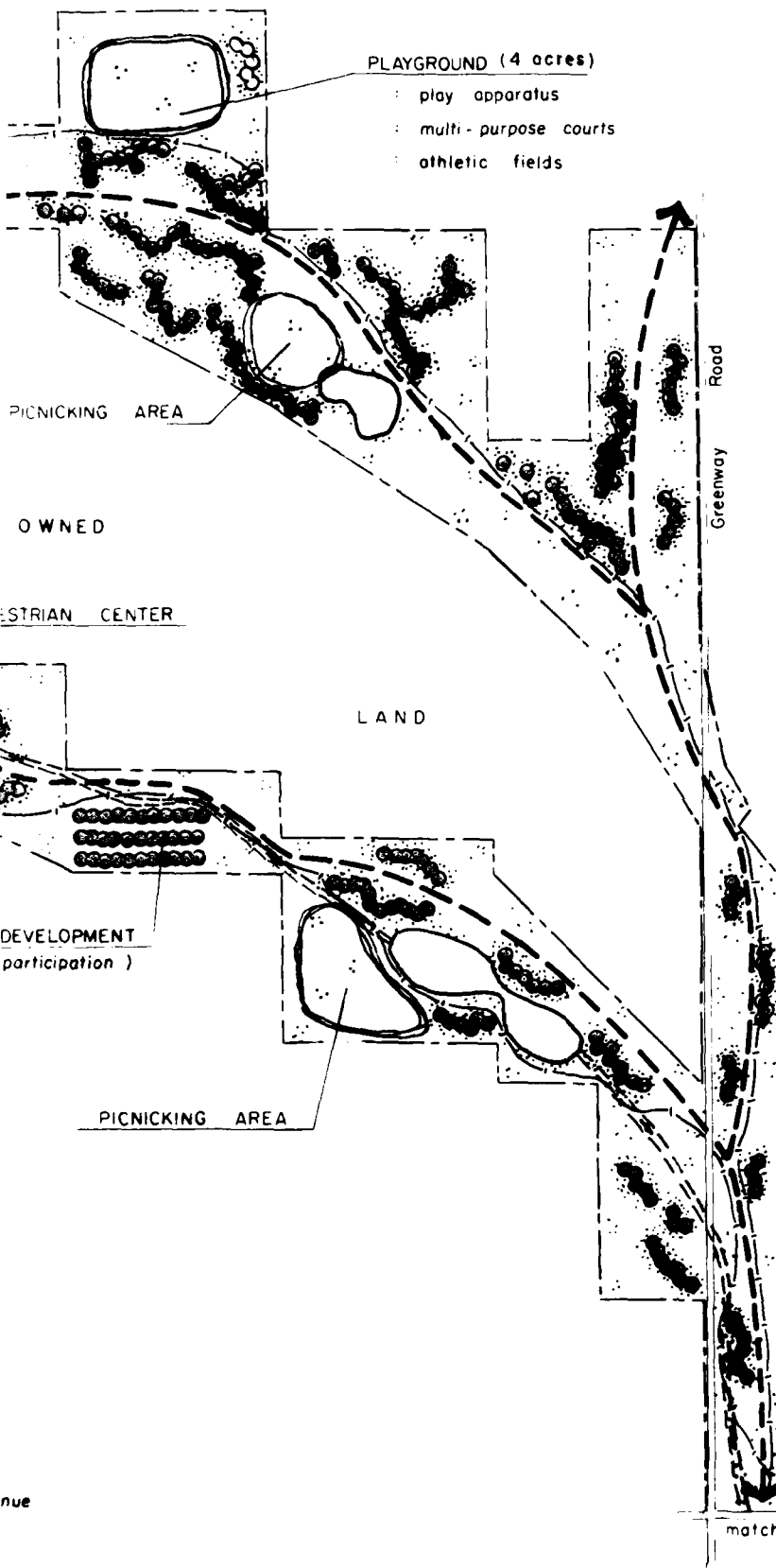
Greenway Road









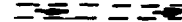
0 500 1000 1500 2000 ft.
0 100 200 300 400 500 600m.

19th Avenue

match



LEGEND

-  DENSELY PLANTED VEGETATION
-  ACTIVITY AREA
-  ARCHEOLOGICAL SITE
-  SCENIC DRIVE
-  PROJECT BOUNDARY
-  CAVE CREEK
-  RIDING AND HIKING TRAIL

**New River & Phoenix
City Streams, Arizona**

**Recreation Site Plan for
Cave Creek Regional Park**

PASSIVE USE AREA

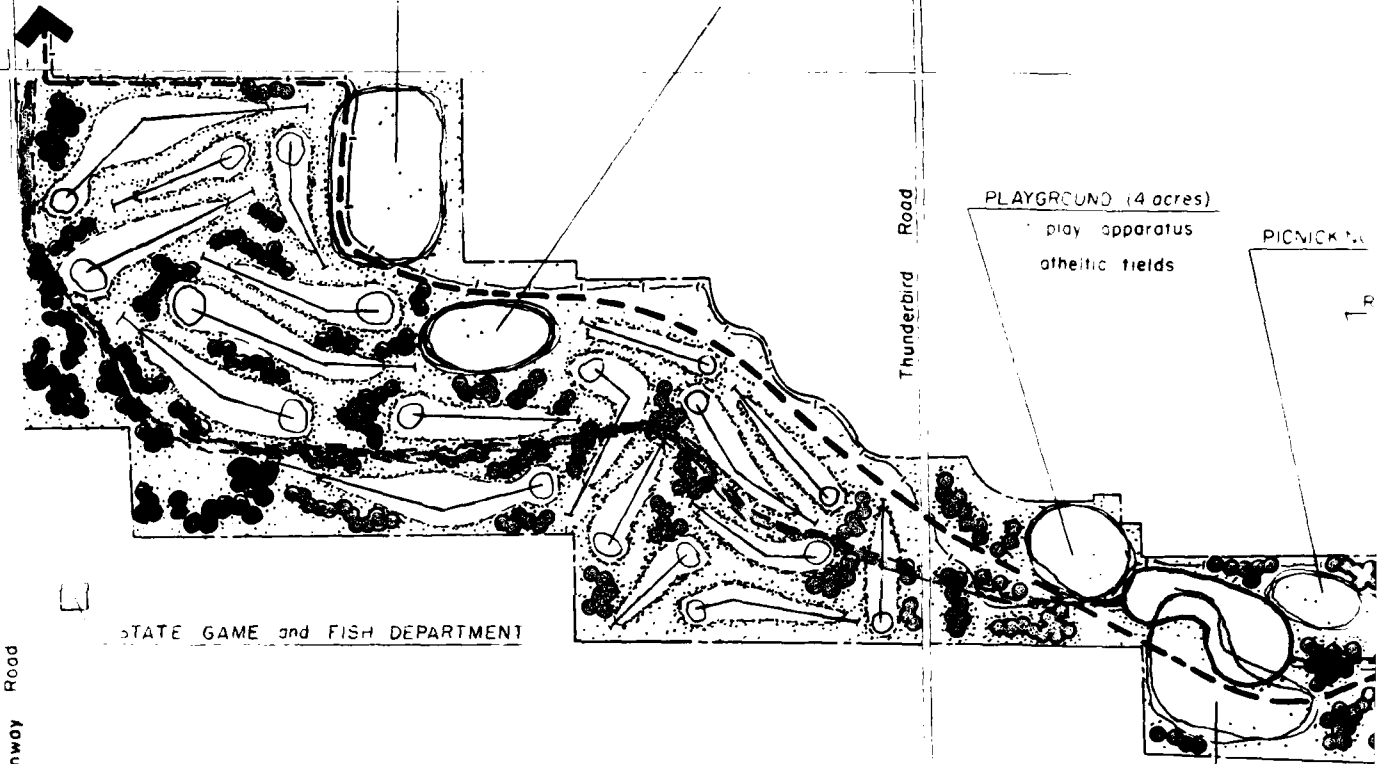
- : amphitheater
- : group picnic area
- : demonstration gardens
- : multi-purpose courts

18-HOLE GOLF COURSE

(no Corps participation)

- : clubhouse
- : driving range
- : putting green

match to plate c

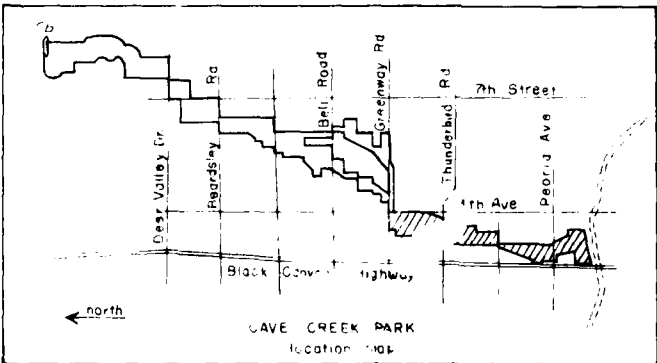


STATE GAME and FISH DEPARTMENT

ALL RECREATION FEATURES BETWEEN GREENWAY ROAD & PEORIA AVENUE ARE 100% LOCAL RESPONSIBILITY.

PASSIVE
band
covered
group

Black Canyon

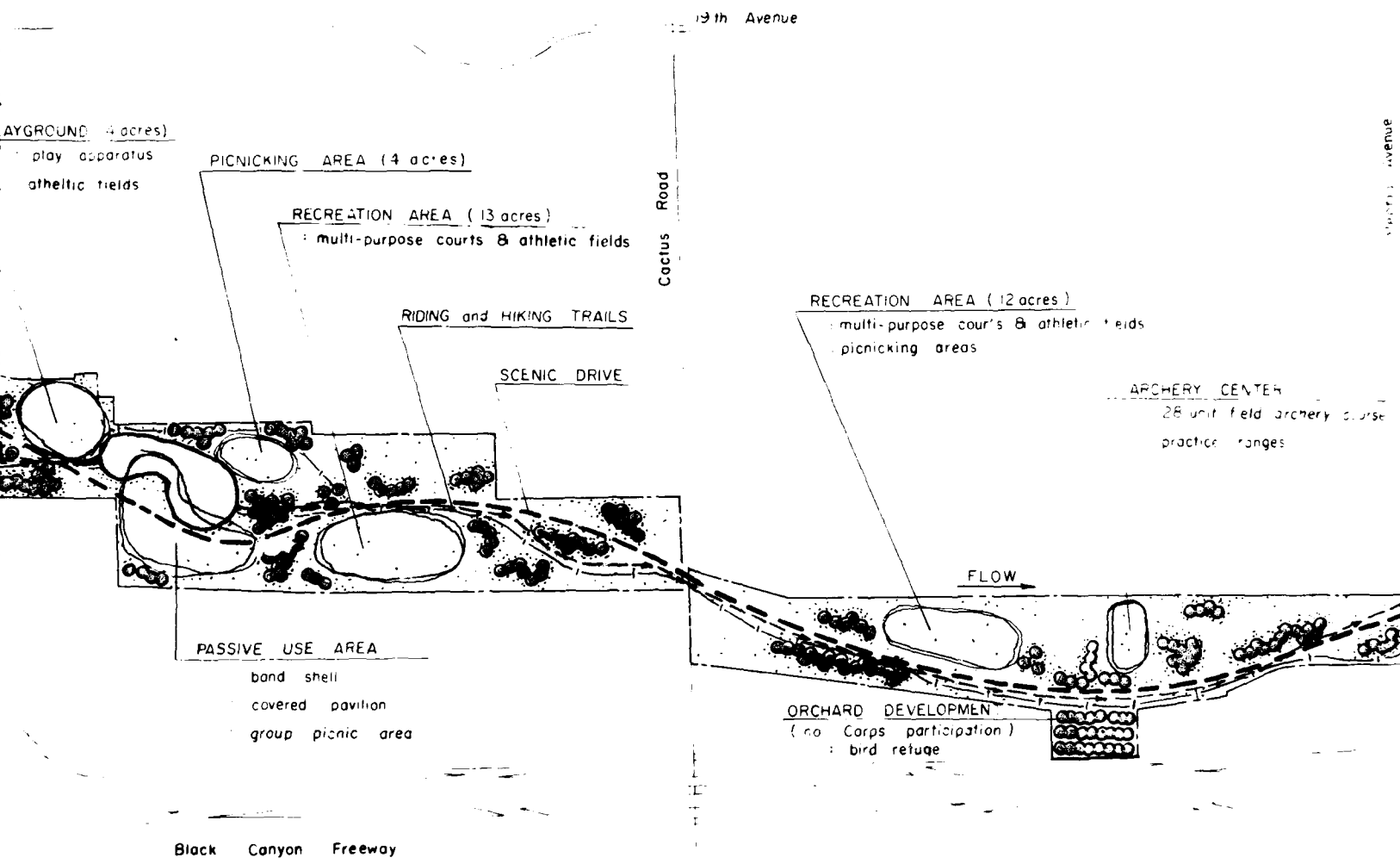


- DENSELY PLANTED VEGETATION
- ACTIVITY AREA
- ARCHEOLOGICAL SITE

COURSE
(location)

ange
reen

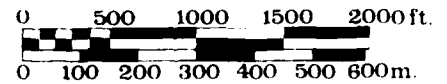
SCENIC DRIVE TRAIL
"TO THE EXHIBITS &
& AFTERNOON TRAIL"



LEGEND

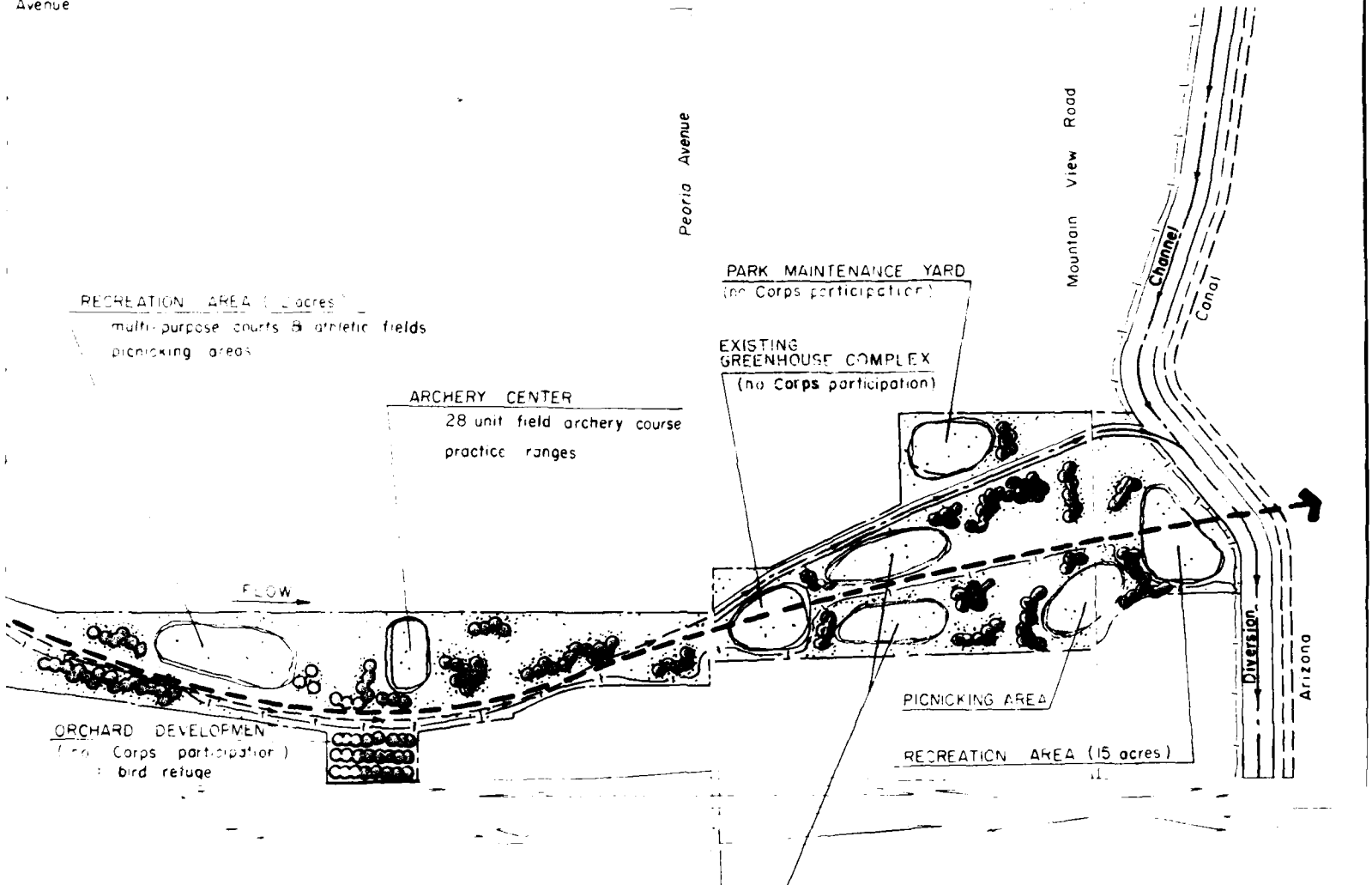
DENSELY PLANTED VEGETATION	-----	SCENIC DRIVE
ACTIVITY AREA	-----	PROJECT BOUNDARY
ARCHEOLOGICAL SITE	=====	CAVE CREEK
	-----	RIDING AND HIKING TRAIL

NATURE STUDY CENTER
outdoor exhibits
indoor exhibits
(no Corps participation)
meeting areas
(no Corps participation)
research and study
(no Corps participation)



SCENIC DRIVE, TRAILS, PICNICKING AREA, RECREATION AREA
OUTDOOR EXHIBITS & LANDSCAPING BETWEEN PEORIA AVENUE
& ARIZONA CANAL DIVERSION CHANNEL ARE COST SHARABLE ITEMS.

Avenue

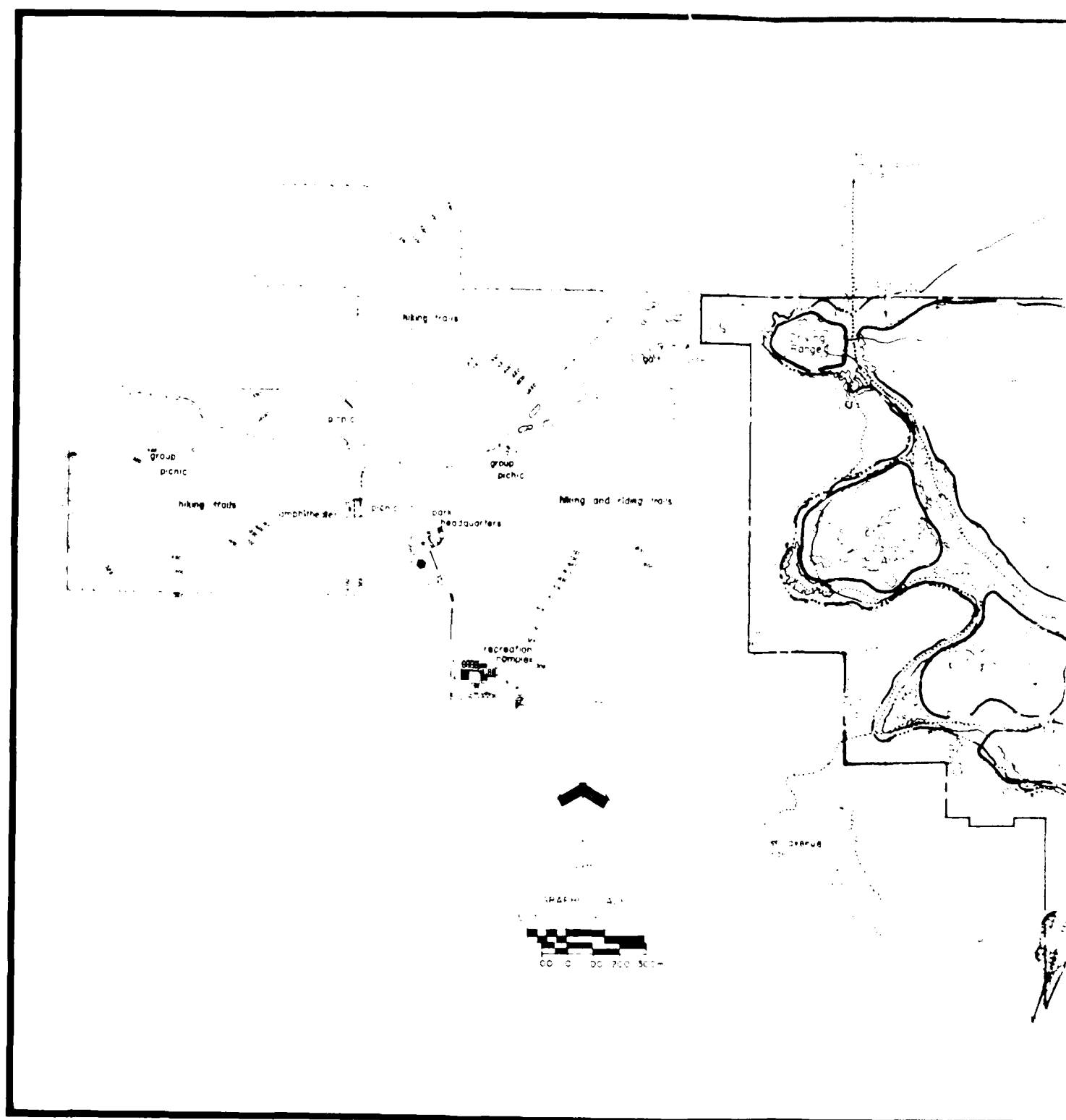


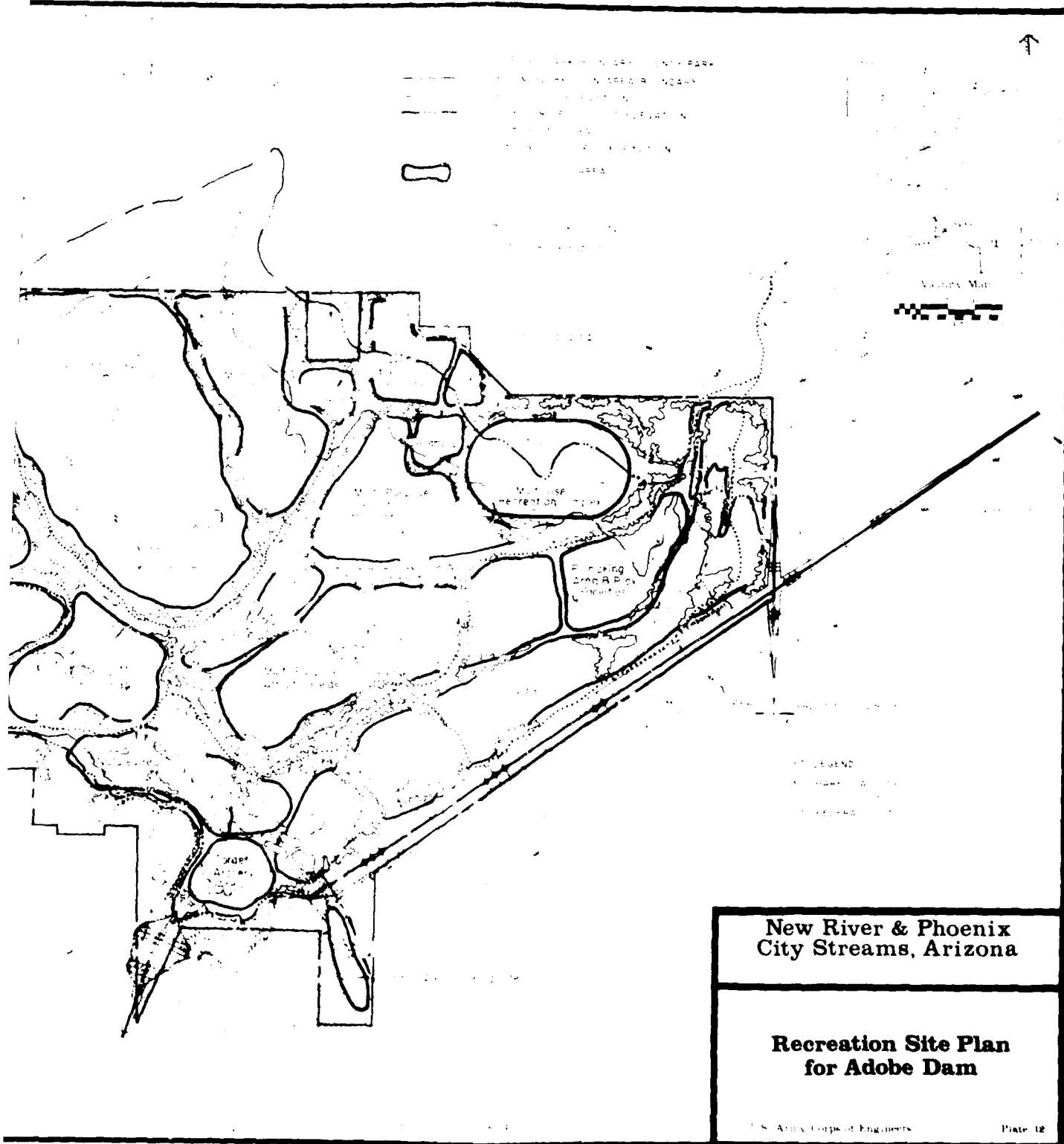
ARY
G TRAIL

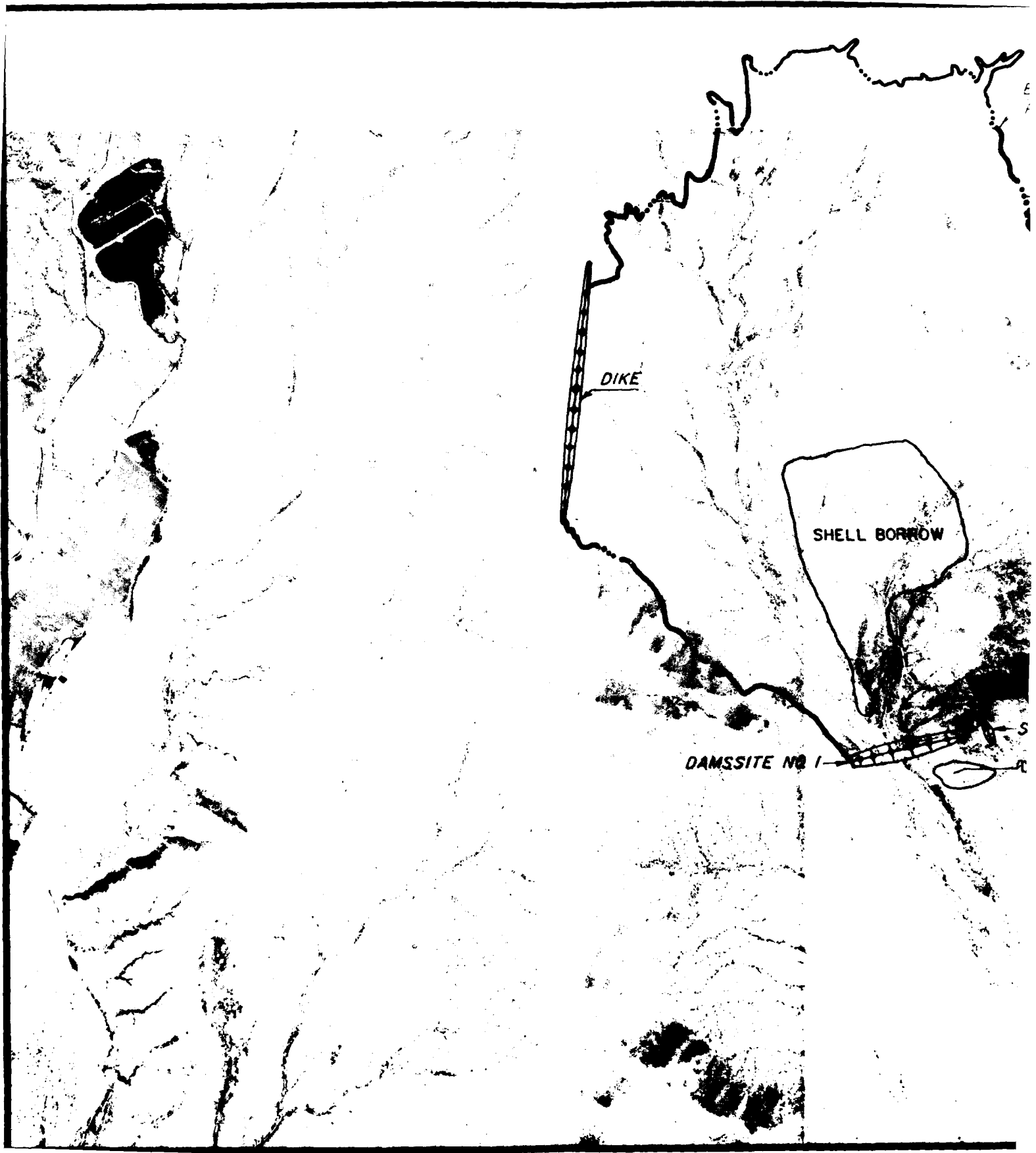
NATURE STUDY CENTER
outdoor exhibits
indoor exhibits
(no Corps participation)
meeting areas
(no Corps participation)
research and study
(no Corps participation)

New River & Phoenix City Streams, Arizona

Recreation Site Plan for Cave Creek Regional Park



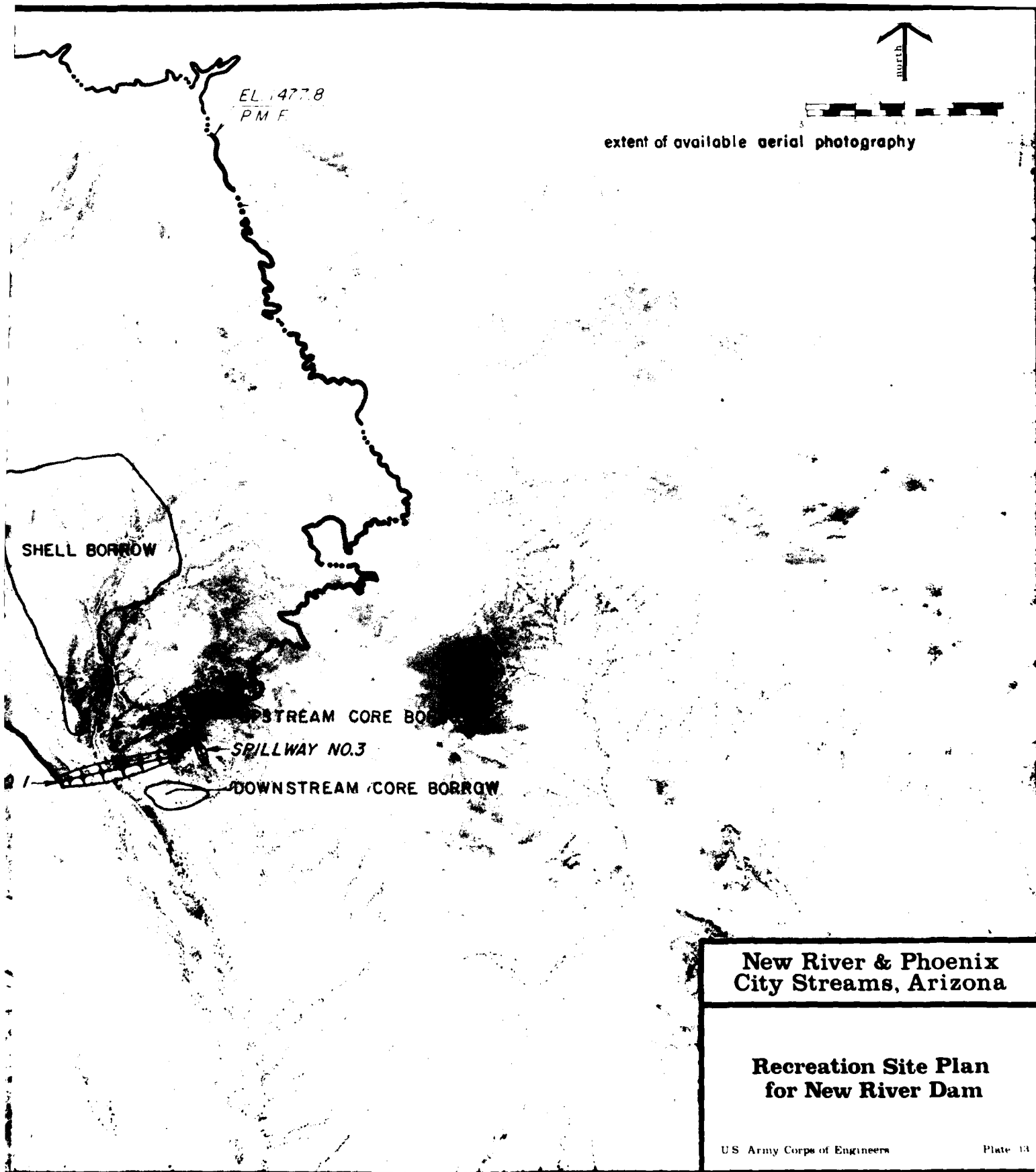


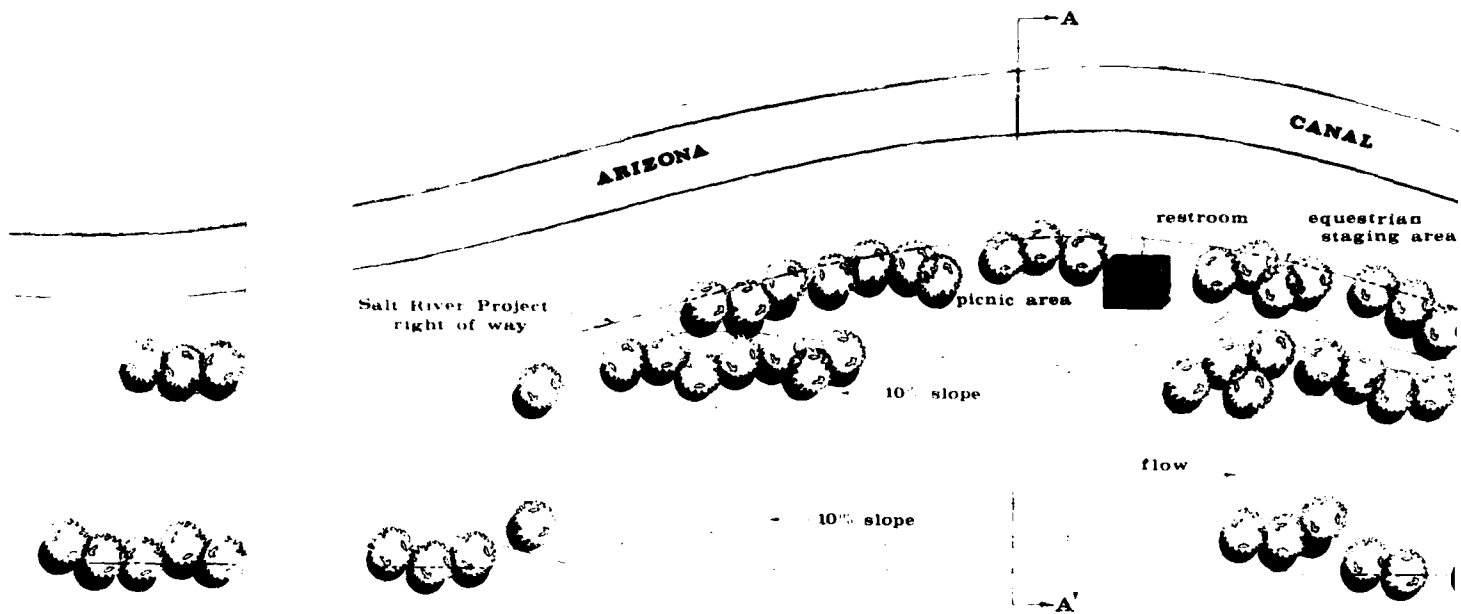


DIKE

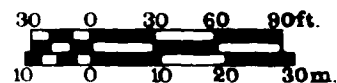
SHELL BORROW

DAMSSITE NO 1

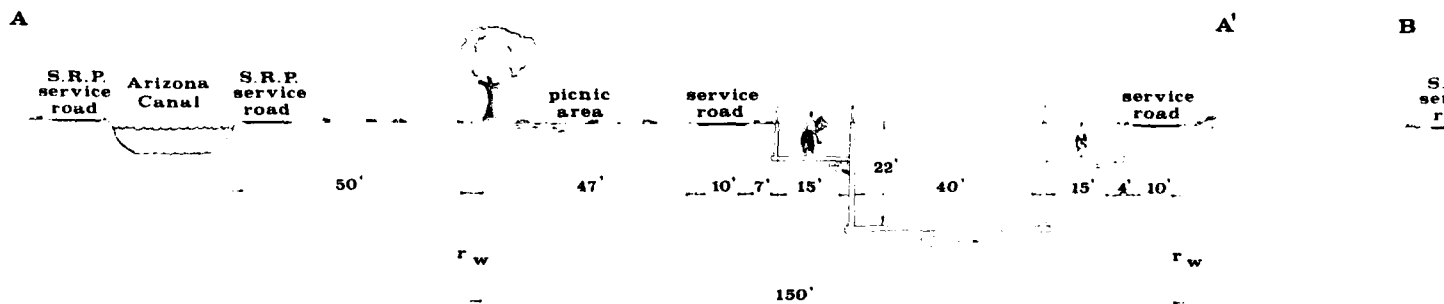
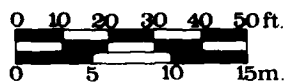


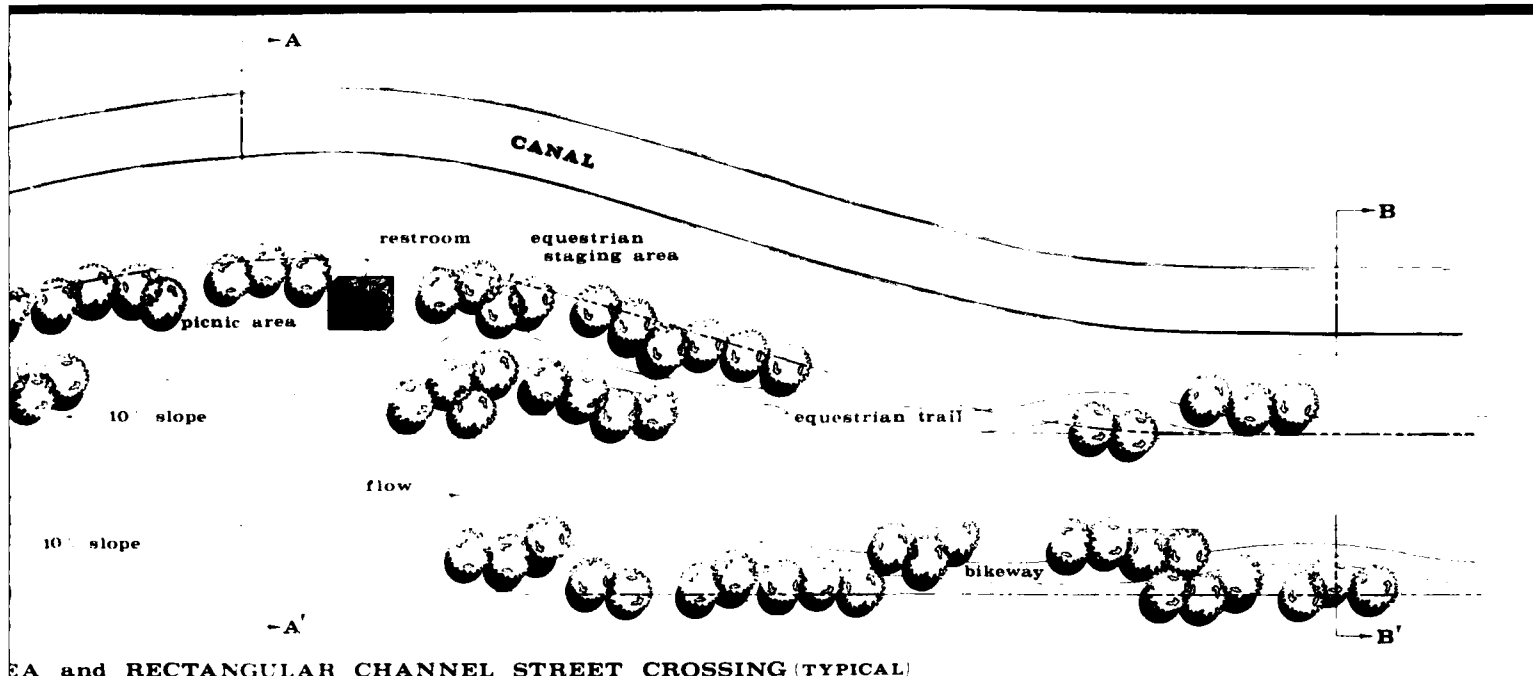


REST AREA and RECTANGULAR CHANNEL STREET CR

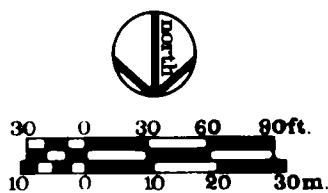


SECTION

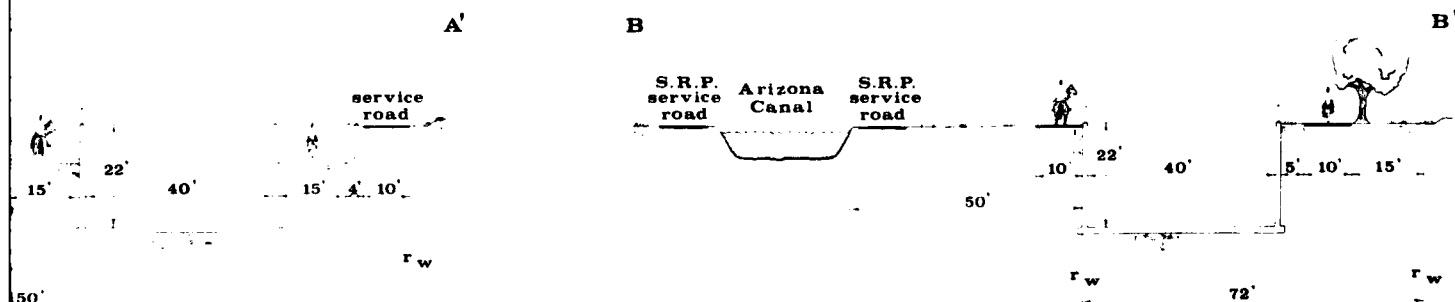
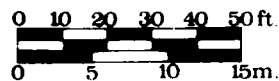




EA and RECTANGULAR CHANNEL STREET CROSSING (TYPICAL)

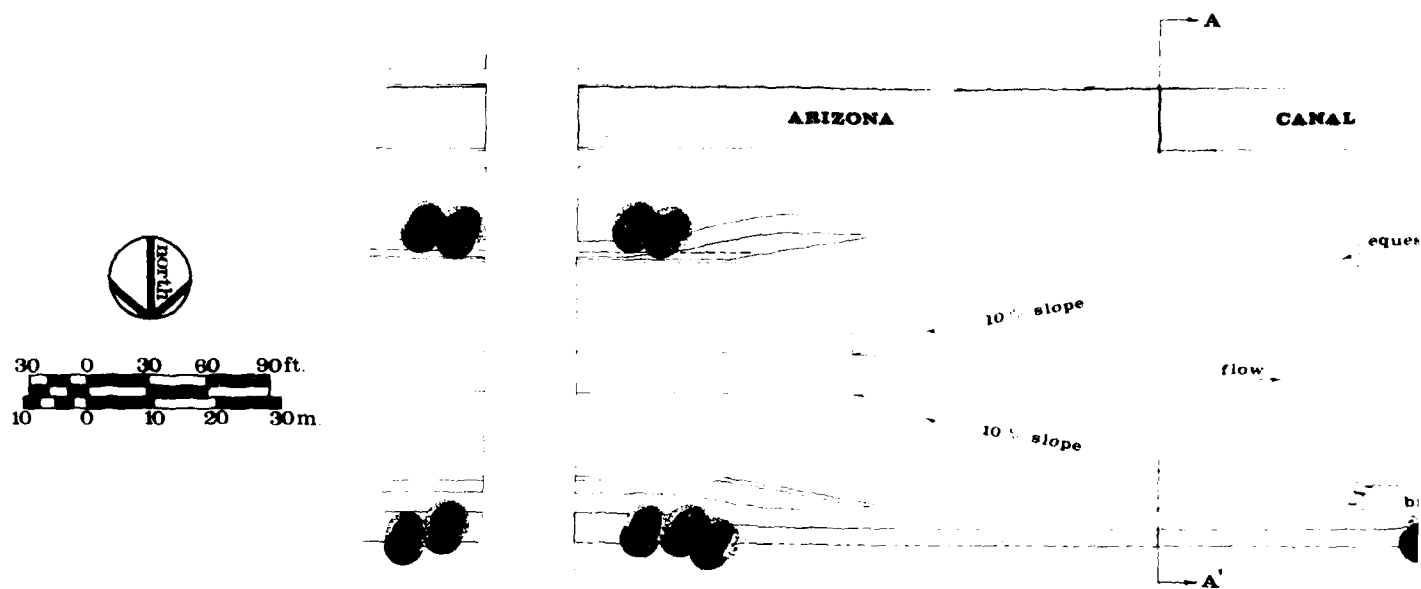


SECTION

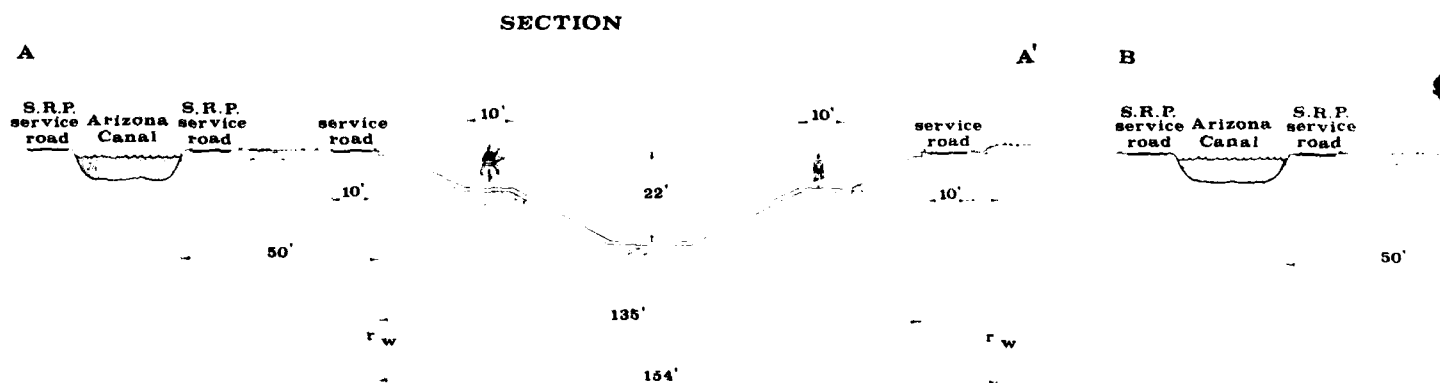


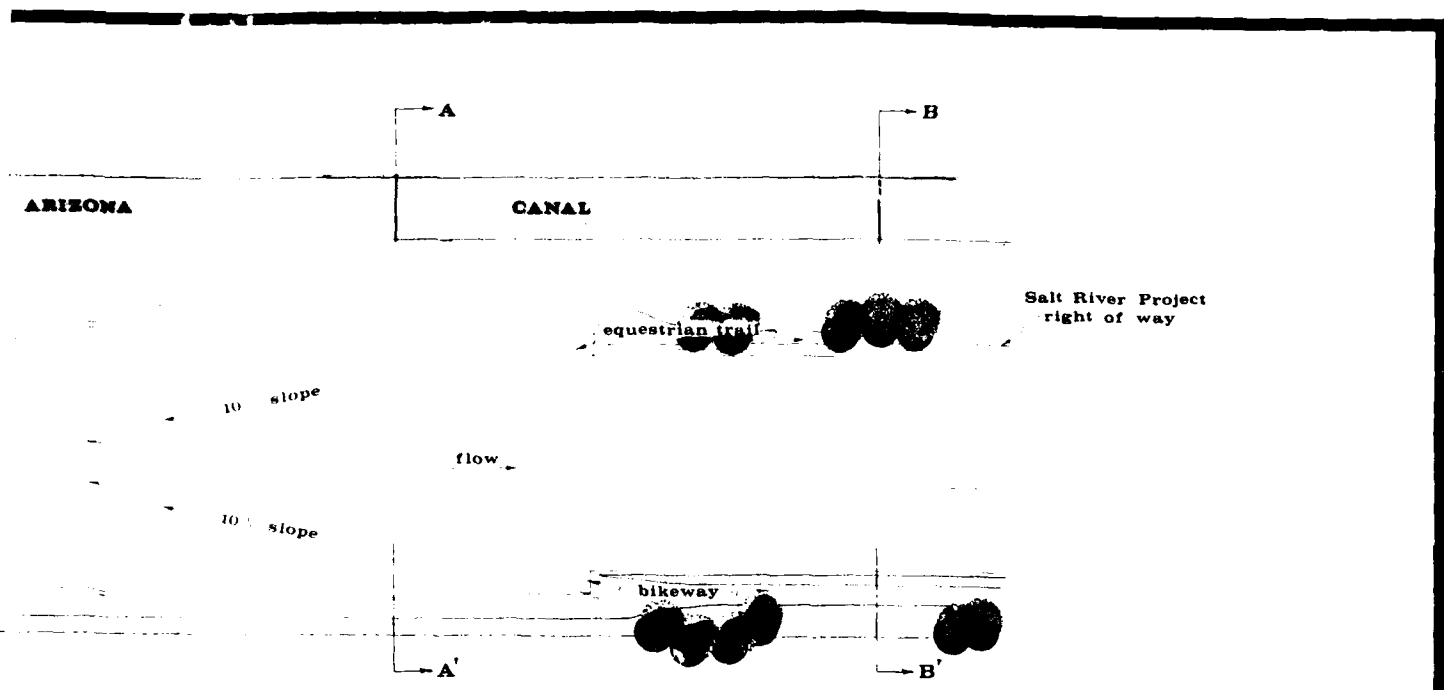
**New River & Phoenix
City Streams, Arizona**

**Recreation Site Plan
for Arizona Canal
Diversion Channel**

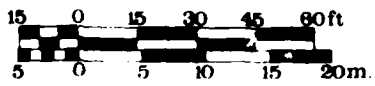
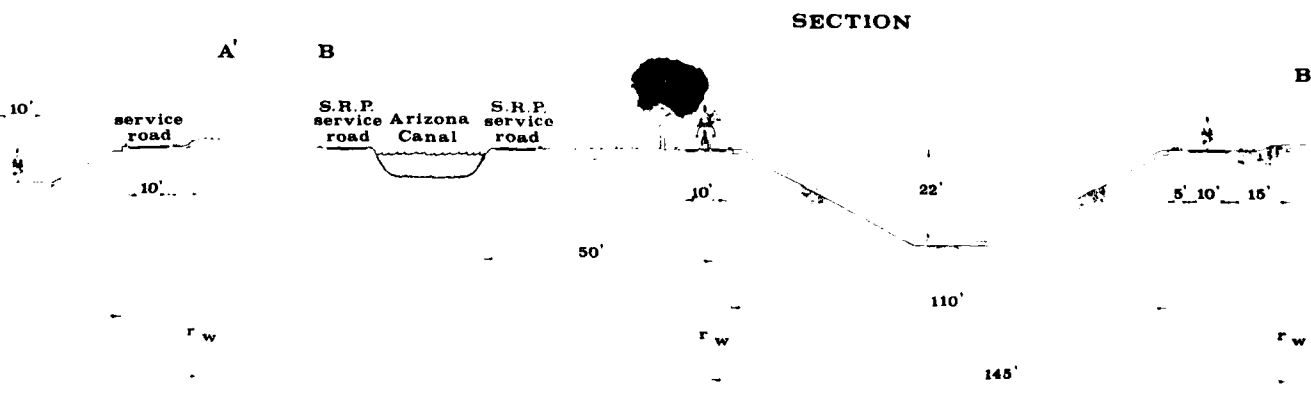


TRAPEZOIDAL CHANNEL STREET CROSSING 11





TRAPEZOIDAL CHANNEL STREET CROSSING (TYPICAL)

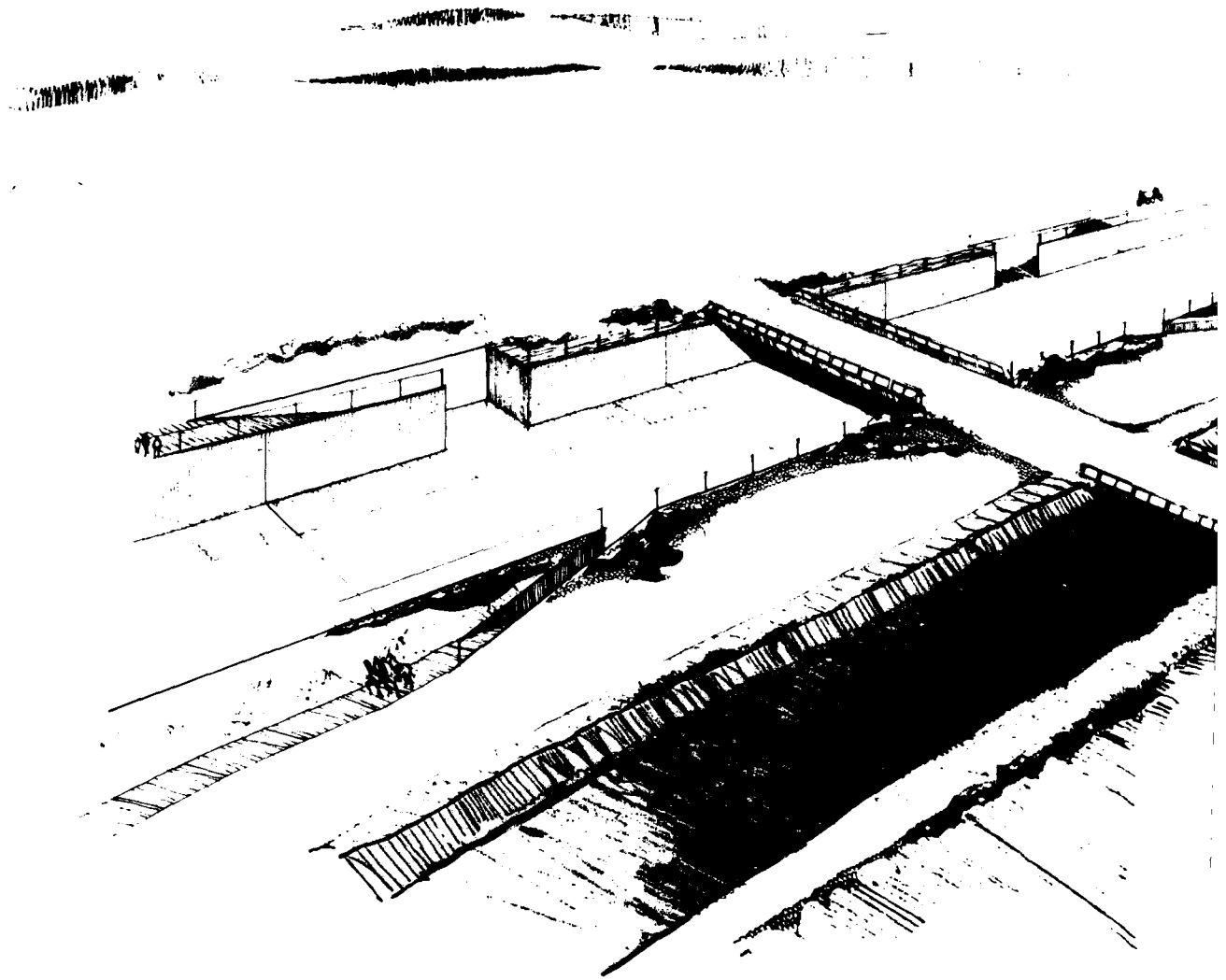


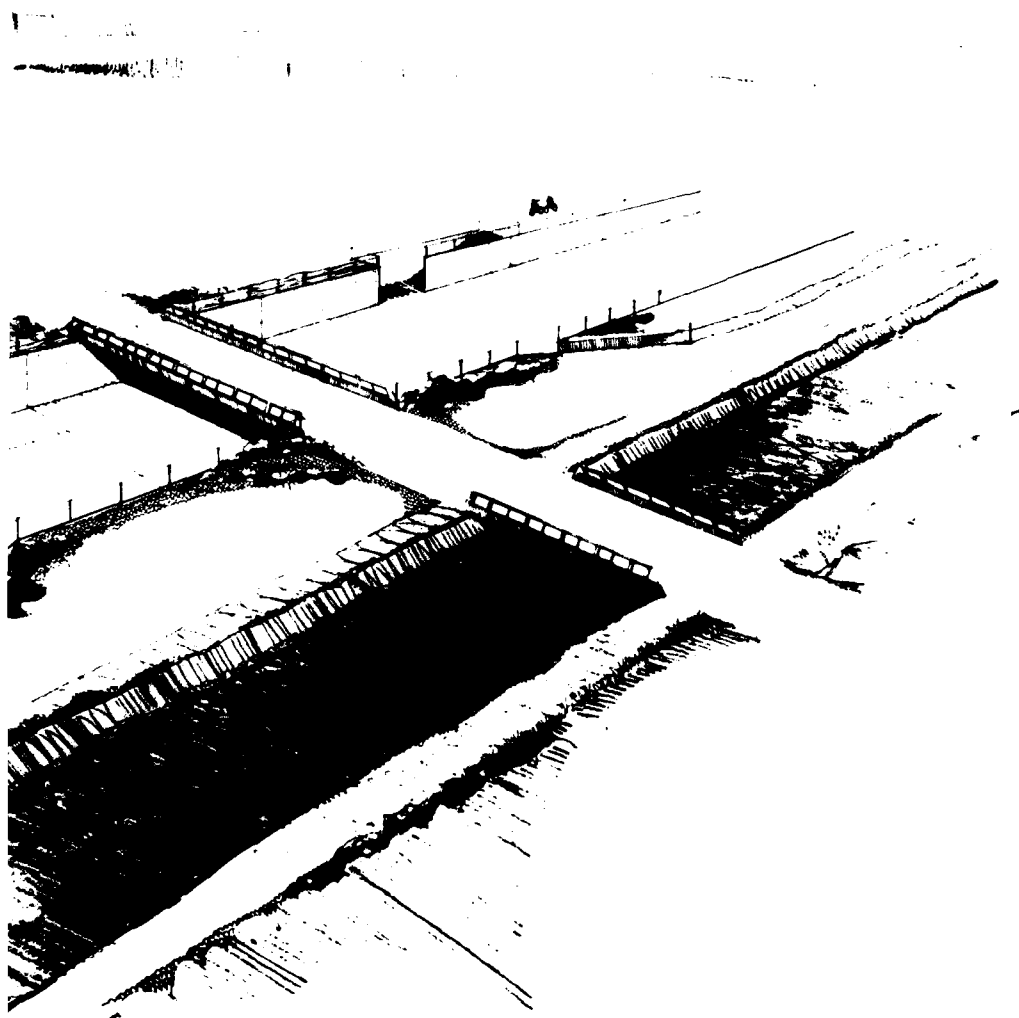
**New River & Phoenix
City Streams, Arizona**

**Recreation Site Plan
for Arizona Canal
Diversion Channel**

U.S. Army Corps of Engineers

Plate 44h



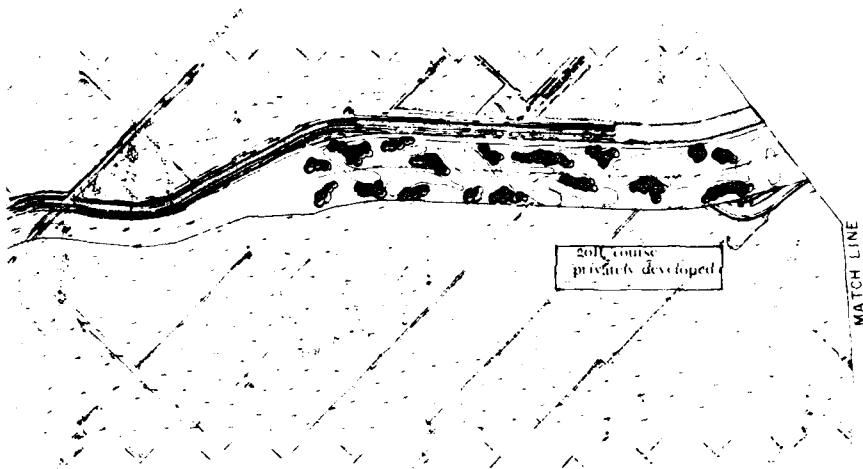


**New River & Phoenix
City Streams, Arizona**

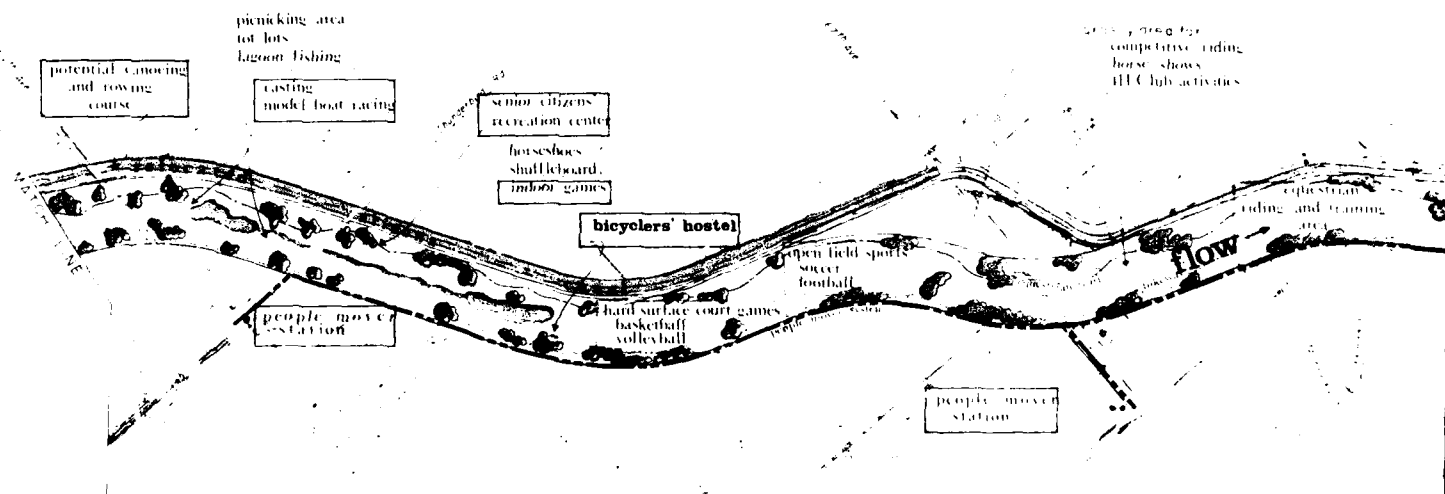
**Recreation Site Plan
for Arizona Canal
Diversion Channel**

U S Army Corps of Engineers

Plate Hc



SKETCH OF PARKWAY



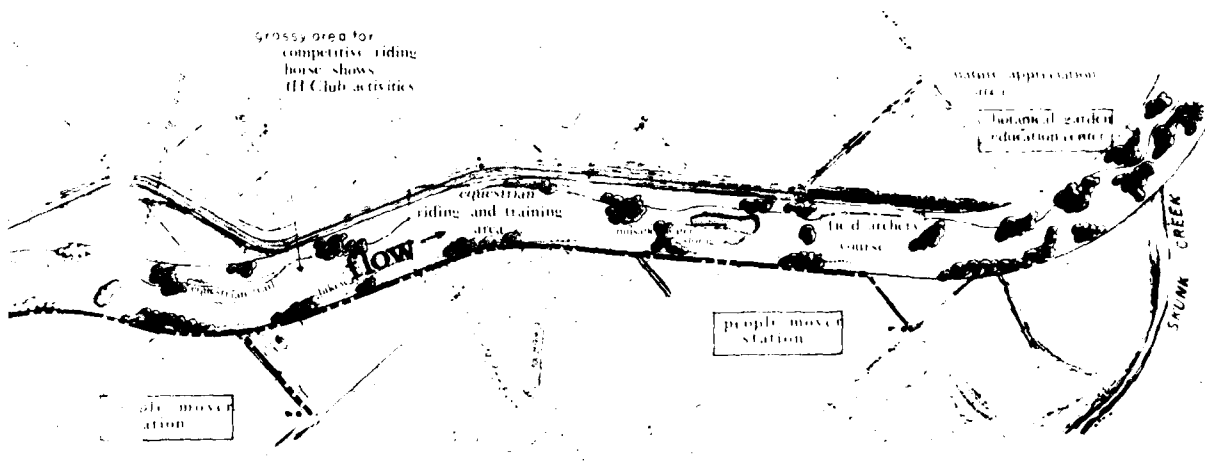
1. 1ST PHASE FACILITY
 2. 2ND PHASE FACILITY
 3. 3RD PHASE FACILITY



0 1000 2000
 0 500m

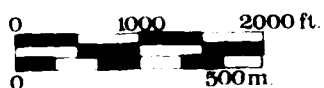


KETCH OF PARKWAY



New River & Phoenix City Streams, Arizona

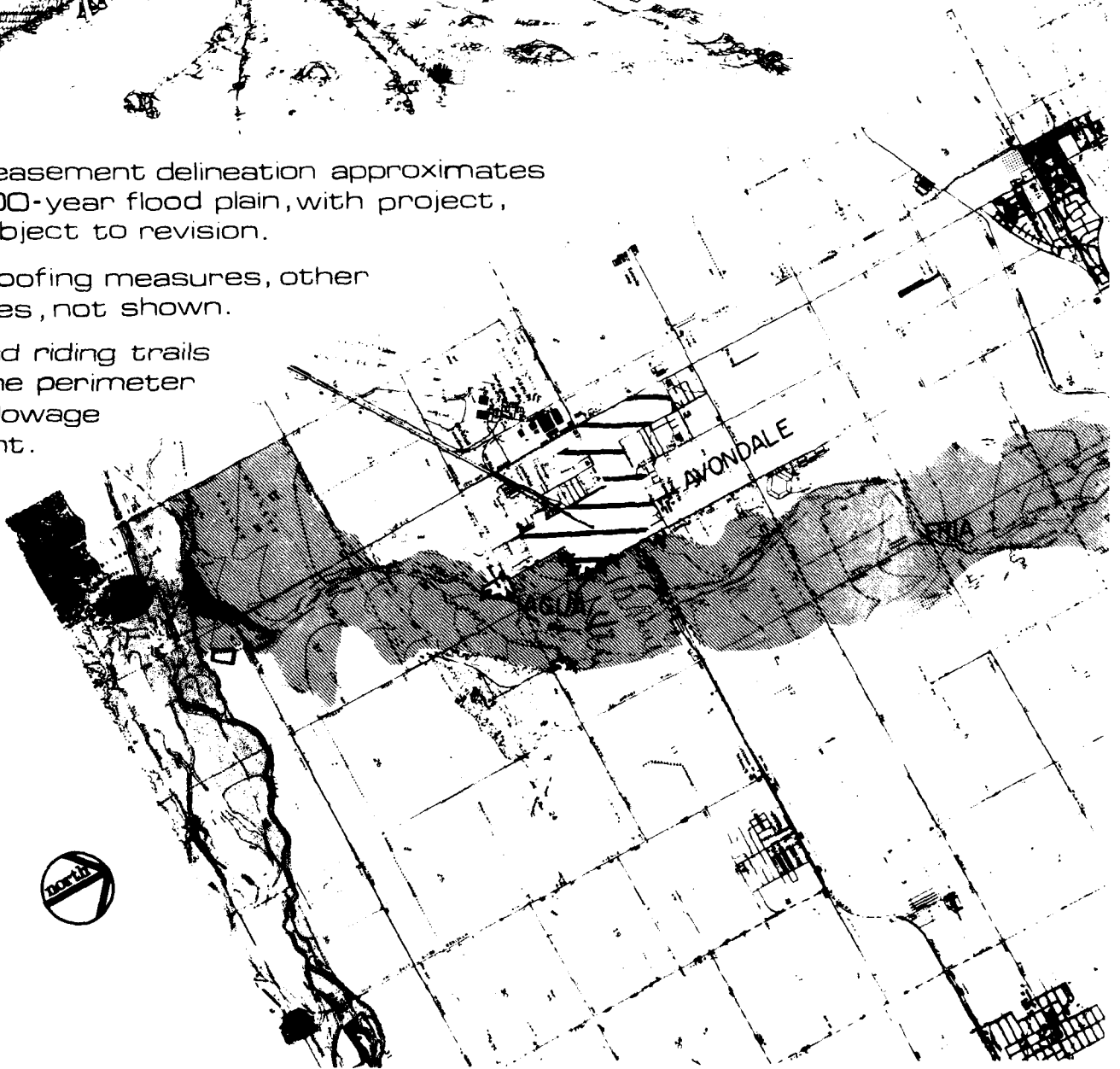
Recreation Site Plan for Arizona Canal Diversion Channel

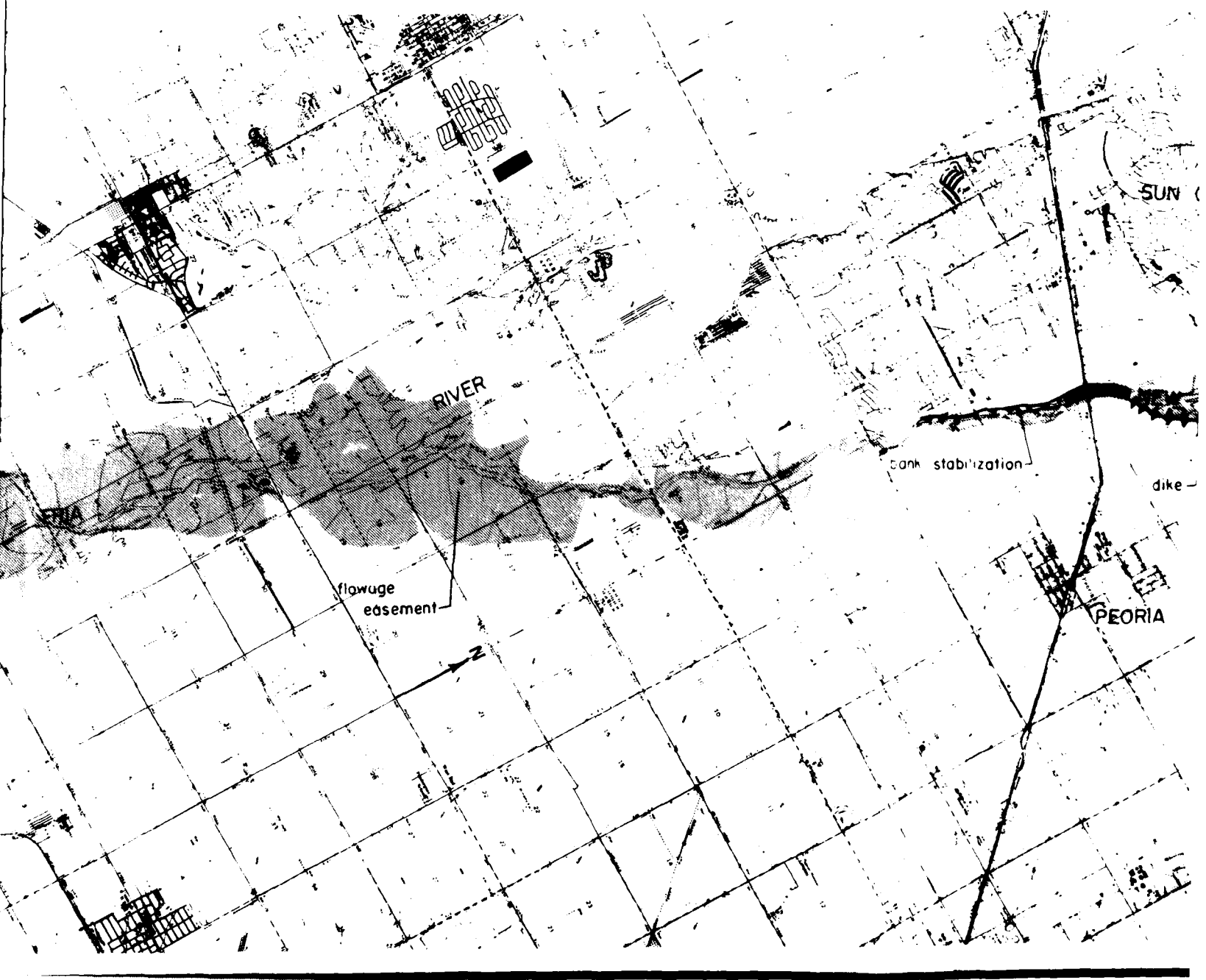
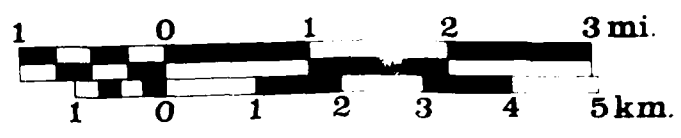


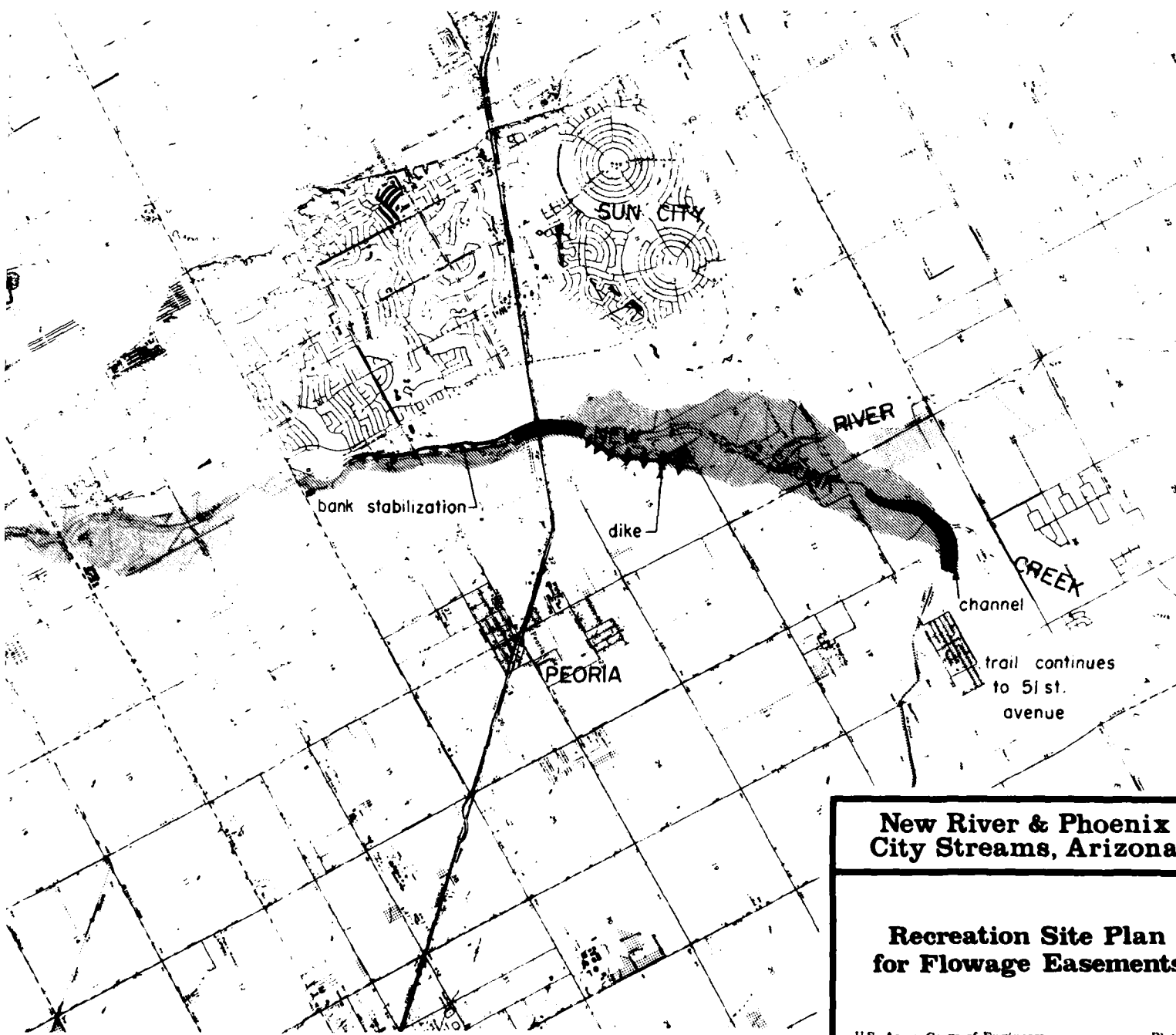
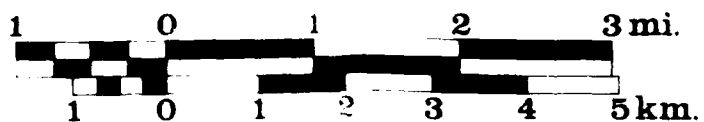


NOTES:

1. flowage easement delineation approximates future 100-year flood plain, with project, and is subject to revision.
2. flood proofing measures, other than dikes, not shown.
3. hiking and riding trails follow the perimeter of the flowage easement.







New River & Phoenix City Streams, Arizona

Recreation Site Plan for Flowage Easements

END

DATE
FILMED

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DTI